

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATIONPHYSICAL SETTING
PHYSICS80 students
69 passing
86% pass
rate

Thursday, June 13, 2013 — 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 term identifies a scalar quantity?

- 22 (1) displacement 12 (3) velocity
4 (2) momentum 42 (4) time

2 Two 20.-newton forces act concurrently on an object. What angle between these forces will produce a resultant force with the greatest magnitude?

- 44 (1) 0° 15 (3) 90.°
17 (2) 45° 4 (4) 180.°

3 A car traveling west in a straight line on a highway decreases its speed from 30.0 meters per second to 23.0 meters per second in 2.00 seconds. The car's average acceleration during this time interval is

- 69 (1) 3.5 m/s² east 2 (3) 13 m/s² east
9 (2) 3.5 m/s² west 0 (4) 13 m/s² west

4 In a race, a runner traveled 12 meters in 4.0 seconds as she accelerated uniformly from rest. The magnitude of the acceleration of the runner was

- 0 (1) 0.25 m/s² 37 (3) 3.0 m/s²
41 (2) 1.5 m/s² 2 (4) 48 m/s²

5 A projectile is launched at an angle above the ground. The horizontal component of the projectile's velocity, v_x , is initially 40. meters per second. The vertical component of the projectile's velocity, v_y , is initially 30. meters per second. What are the components of the projectile's velocity after 2.0 seconds of flight? [Neglect friction.]

- 55 (1) $v_x = 40.$ m/s and $v_y = 10.$ m/s
18 (2) $v_x = 40.$ m/s and $v_y = 30.$ m/s
4 (3) $v_x = 20.$ m/s and $v_y = 10.$ m/s
3 (4) $v_x = 20.$ m/s and $v_y = 30.$ m/s

6 A ball is thrown with an initial speed of 10. meters per second. At what angle above the horizontal should the ball be thrown to reach the greatest height?

- 3 (1) 0° 14 (3) 45°
1 (2) 30.° 62 (4) 90.°

7 Which object has the greatest inertia?

- 5 (1) a 0.010-kg bullet traveling at 90. m/s
2 (2) a 30.-kg child traveling at 10. m/s on her bike
13 (3) a 490-kg elephant walking with a speed of 1.0 m/s
60 (4) a 1500-kg car at rest in a parking lot

8 An 8.0-newton wooden block slides across a horizontal wooden floor at constant velocity. What is the magnitude of the force of kinetic friction between the block and the floor?

- 68 (1) 2.4 N 8 (3) 8.0 N
2 (2) 3.4 N 1 (4) 27 N

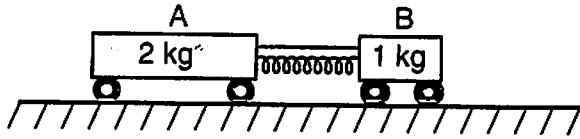
9 Which situation represents a person in equilibrium?

- 0 (1) a child gaining speed while sliding down a slide
1 (2) a woman accelerating upward in an elevator
78 (3) a man standing still on a bathroom scale
1 (4) a teenager driving around a corner in his car

10 A rock is thrown straight up into the air. At the highest point of the rock's path, the magnitude of the net force acting on the rock is

- 3 (1) less than the magnitude of the rock's weight, but greater than zero
2 (2) greater than the magnitude of the rock's weight
41 (3) the same as the magnitude of the rock's weight
34 (4) zero

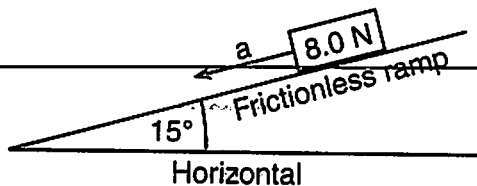
- 11 The diagram below shows a compressed spring between two carts initially at rest on a horizontal, frictionless surface. Cart A has a mass of 2 kilograms and cart B has a mass of 1 kilogram. A string holds the carts together.



The string is cut and the carts move apart. Compared to the magnitude of the force the spring exerts on cart A, the magnitude of the force the spring exerts on cart B is

- 65 (1) the same 8 (3) twice as great
7 (2) half as great 0 (4) four times as great

- 12 An 8.0-newton block is accelerating down a frictionless ramp inclined at 15° to the horizontal, as shown in the diagram below.



What is the magnitude of the net force causing the block's acceleration?

- 4 (1) 0 N 10 (3) 7.7 N
40 (2) 2.1 N 26 (4) 8.0 N

- 13 At a certain location, a gravitational force with a magnitude of 350 newtons acts on a 70.-kilogram astronaut. What is the magnitude of the gravitational field strength at this location?

- 0 (1) 0.20 kg/N 28 (3) 9.8 m/s²
76 (2) 5.0 N/kg 2 (4) 25 000 N•kg

- 14 A spring gains 2.34 joules of elastic potential energy as it is compressed 0.250 meter from its equilibrium position. What is the spring constant of this spring?

- 18 (1) 9.36 N/m 3 (3) 37.4 N/m
6 (2) 18.7 N/m 53 (4) 74.9 N/m

- 15 When a teacher shines light on a photocell attached to a fan, the blades of the fan turn. The brighter the light shone on the photocell, the faster the blades turn. Which energy conversion is illustrated by this demonstration?

- 21 (1) light → thermal → mechanical
1 (2) light → nuclear → thermal
58 (3) light → electrical → mechanical
0 (4) light → mechanical → chemical

- 16 Which statement describes a characteristic common to all electromagnetic waves and mechanical waves?

- 4 (1) Both types of waves travel at the same speed.
13 (2) Both types of waves require a material medium for propagation.
1 (3) Both types of waves propagate in a vacuum.
62 (4) Both types of waves transfer energy.

- 17 An electromagnetic wave is produced by charged particles vibrating at a rate of 3.9×10^8 vibrations per second. The electromagnetic wave is classified as

- 74 (1) a radio wave 4 (3) an x ray
0 (2) an infrared wave 2 (4) visible light

- 18 The energy of a sound wave is most closely related to the wave's

- 29 (1) frequency 6 (3) wavelength
32 (2) amplitude 13 (4) speed

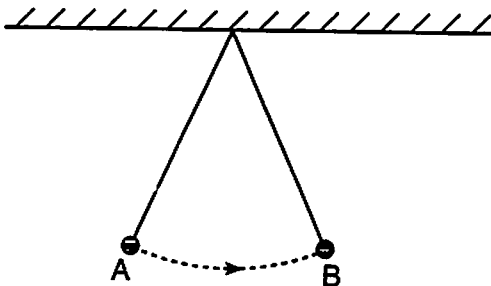
- 19 A sound wave traveling eastward through air causes the air molecules to

- 26 (1) vibrate east and west
48 (2) vibrate north and south
6 (3) move eastward, only
0 (4) move northward, only

- 20 What is the speed of light ($f = 5.09 \times 10^{14}$ Hz) in ethyl alcohol?

- 3 (1) 4.53×10^{-9} m/s 3 (3) 1.24×10^8 m/s
2 (2) 2.43×10^2 m/s 72 (4) 2.21×10^8 m/s

21 In the diagram below, an ideal pendulum released from position A swings freely to position B.

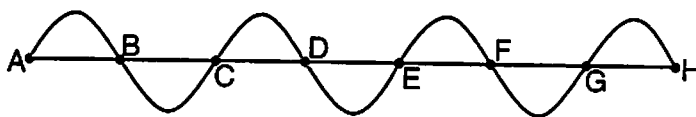


As the pendulum swings from A to B, its total mechanical energy

- 6 (1) decreases, then increases
1 (2) increases, only

- 33 (3) increases, then decreases
40 (4) remains the same

22 The diagram below represents a periodic wave.

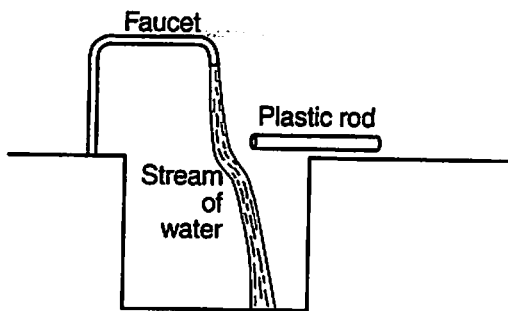


Which two points on the wave are out of phase?

- 3 (1) A and C
8 (2) B and F

- 5 (3) C and E
64 (4) D and G

23 A dry plastic rod is rubbed with wool cloth and then held near a thin stream of water from a faucet. The path of the stream of water is changed, as represented in the diagram below.



Which force causes the path of the stream of water to change due to the plastic rod?

- 0 (1) nuclear
6 (2) magnetic

- 72 (3) electrostatic
2 (4) gravitational

24 A distance of 1.0×10^{-2} meter separates successive crests of a periodic wave produced in a shallow tank of water. If a crest passes a point in the tank every 4.0×10^{-1} second, what is the speed of this wave?

- 1 (1) 2.5×10^{-4} m/s 38 (3) 2.5×10^{-2} m/s
 38 (2) 4.0×10^{-3} m/s 3 (4) 4.0×10^{-1} m/s

25 One vibrating 256-hertz tuning fork transfers energy to another 256-hertz tuning fork, causing the second tuning fork to vibrate. This phenomenon is an example of

- 2 (1) diffraction 2 (3) refraction
 1 (2) reflection 35 (4) resonance

26 Sound waves are produced by the horn of a truck that is approaching a stationary observer. Compared to the sound waves detected by the driver of the truck, the sound waves detected by the observer have a greater

- 18 (1) wavelength 8 (3) period
 61 (2) frequency 3 (4) speed

27 The electronvolt is a unit of

- 57 (1) energy
 11 (2) charge
 2 (3) electric field strength
 10 (4) electric potential difference

28 Which particle would produce a magnetic field?

- 0 (1) a neutral particle moving in a straight line
 0 (2) a neutral particle moving in a circle
 24 (3) a stationary charged particle
 53 (4) a moving charged particle

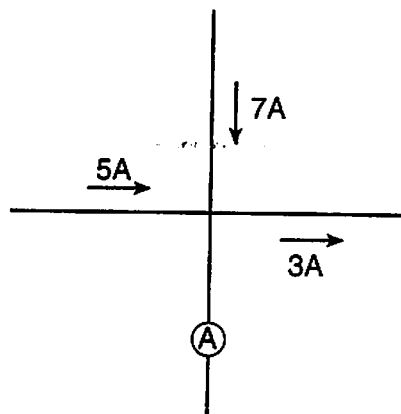
29 A physics student takes her pulse and determines that her heart beats periodically 60 times in 60 seconds. The period of her heartbeat is

- 15 (1) 1 Hz 59 (3) 1 s
 2 (2) 60 Hz 3 (4) 60 s

30 Moving 4.0 coulombs of charge through a circuit requires 48 joules of electric energy. What is the potential difference across this circuit?

- 1 (1) 190 V 77 (3) 12 V
 2 (2) 48 V 0 (4) 4.0 V

31 The diagram below shows currents in a segment of an electric circuit.



What is the reading of ammeter A?

- 11 (1) 1 A 24 (3) 9 A
 15 (2) 5 A 27 (4) 15 A

32 An electric dryer consumes 6.0×10^6 joules of electrical energy when operating at 220 volts for 1.8×10^3 seconds. During operation, the dryer draws a current of

- 0 (1) 10. A 1 (3) 9.0×10^2 A
 67 (2) 15 A 12 (4) 3.3×10^3 A

33 Which net charge could be found on an object?

- 58 (1) $+4.80 \times 10^{-19}$ C 6 (3) -2.40×10^{-19} C
 14 (2) $+2.40 \times 10^{-19}$ C 2 (4) -5.60×10^{-19} C

34 A photon is emitted as the electron in a hydrogen atom drops from the $n = 5$ energy level directly to the $n = 3$ energy level. What is the energy of the emitted photon?

- 2 (1) 0.85 eV 1 (3) 1.51 eV
 70 (2) 0.97 eV 7 (4) 2.05 eV

35 In a process called pair production, an energetic gamma ray is converted into an electron and a positron. It is *not* possible for a gamma ray to be converted into two electrons because

- 50 (1) charge must be conserved
 1 (2) momentum must be conserved
 23 (3) mass-energy must be conserved
 6 (4) baryon number must be conserved

Part B-1

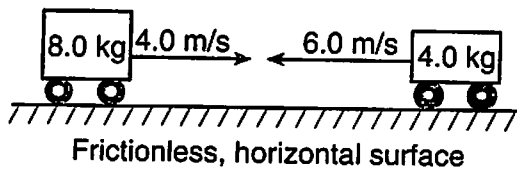
Answer all questions in this part.

Directions (36–50): For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the 2006 Edition Reference Tables for Physical Setting/Physics. Record your answers on your separate answer sheet.

36 The approximate length of an unsharpened No. 2 pencil is

- 18 (1) 2.0×10^{-2} m 3 (3) 2.0×10^0 m
 59 (2) 2.0×10^{-1} m 0 (4) 2.0×10^1 m

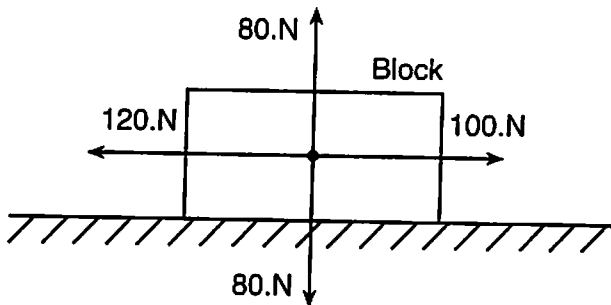
37 The diagram below shows an 8.0-kilogram cart moving to the right at 4.0 meters per second about to make a head-on collision with a 4.0-kilogram cart moving to the left at 6.0 meters per second.



After the collision, the 4.0-kilogram cart moves to the right at 3.0 meters per second. What is the velocity of the 8.0-kilogram cart after the collision?

- 34 (1) 0.50 m/s left 19 (3) 5.5 m/s left
 23 (2) 0.50 m/s right 3 (4) 5.5 m/s right

38 Four forces act concurrently on a block on a horizontal surface as shown in the diagram below.



As a result of these forces, the block

- 1 (1) moves at constant speed to the right
 31 (2) moves at constant speed to the left
 0 (3) accelerates to the right
 44 (4) accelerates to the left

39 If a motor lifts a 400.-kilogram mass a vertical distance of 10. meters in 8.0 seconds, the *minimum* power generated by the motor is

- 5 (1) 3.2×10^2 W 47 (3) 4.9×10^3 W
 24 (2) 5.0×10^2 W 4 (4) 3.2×10^4 W

40 A 4.0-kilogram object is accelerated at 3.0 meters per second² north by an unbalanced force. The same unbalanced force acting on a 2.0-kilogram object will accelerate this object toward the north at

- 2 (1) 12 m/s² 5 (3) 3.0 m/s²
 72 (2) 6.0 m/s² 1 (4) 1.5 m/s²

41 An electron is located in an electric field of magnitude 600. newtons per coulomb. What is the magnitude of the electrostatic force acting on the electron?

- 14 (1) 3.75×10^{21} N 51 (3) 9.60×10^{-17} N
 12 (2) 6.00×10^2 N 3 (4) 2.67×10^{-22} N

42 The current in a wire is 4.0 amperes. The time required for 2.5×10^{19} electrons to pass a certain point in the wire is

- 53 (1) 1.0 s 8 (3) 0.50 s
 11 (2) 0.25 s 8 (4) 4.0 s

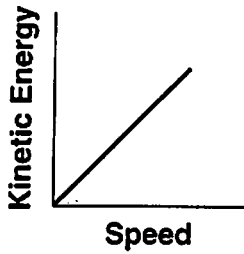
43 When two point charges of magnitude q_1 and q_2 are separated by a distance, r , the magnitude of the electrostatic force between them is F . What would be the magnitude of the electrostatic force between point charges $2q_1$ and $4q_2$ when separated by a distance of $2r$?

- 5 (1) F 4 (3) $16F$
 47 (2) $2F$ 24 (4) $4F$

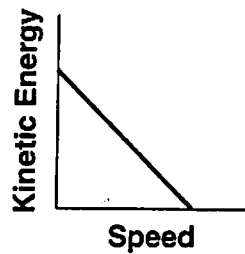
44 The composition of a meson with a charge of -1 elementary charge could be

- 54 (1) $s\bar{c}$ 5 (3) $u\bar{b}$
 20 (2) $d s s$ 1 (4) $u\bar{c}\bar{d}$

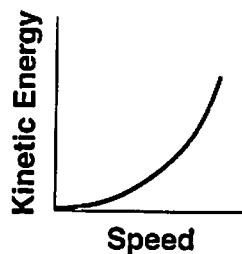
45 Which graph represents the relationship between the kinetic energy and the speed of a freely falling object?



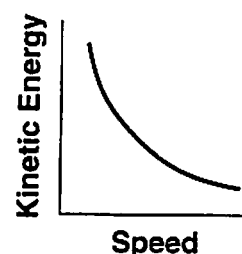
25 (1)



1 (2)

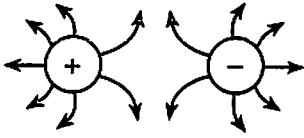


53 (3)

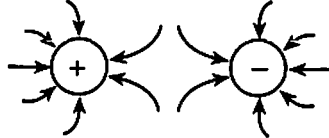


1 (4)

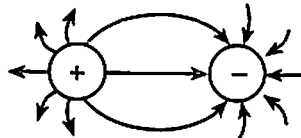
46 Which diagram represents the electric field between two oppositely charged conducting spheres?



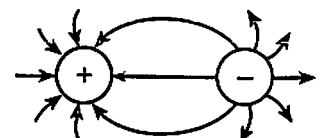
1 (1)



2 (2)

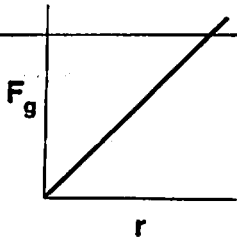


64 (3)

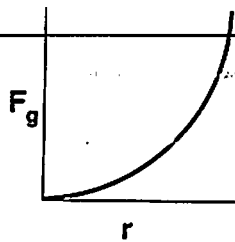


13 (4)

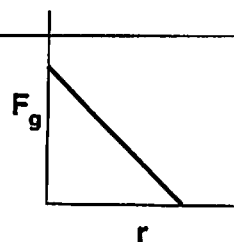
47 Which graph represents the relationship between the magnitude of the gravitational force, F_g , between two masses and the distance, r , between the centers of the masses?



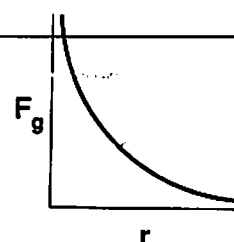
4 (1)



4 (2)

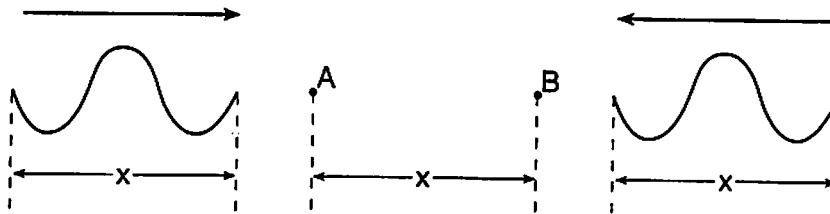


5 (3)



67 (4)

48 The diagram below shows two waves traveling toward each other at equal speed in a uniform medium.

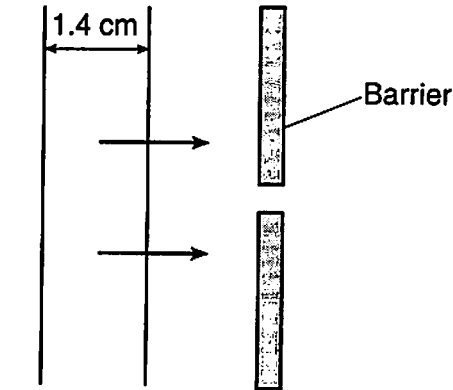


When both waves are in the region between points A and B, they will undergo

- 1 (1) diffraction
- 3 (2) the Doppler effect

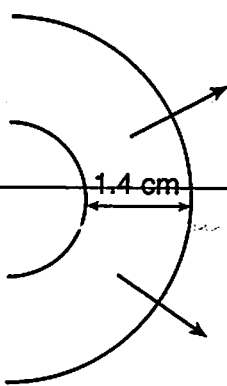
- 13 (3) destructive interference
- 63 (4) constructive interference

49 The diagram below shows a series of straight wave fronts produced in a shallow tank of water approaching a small opening in a barrier.

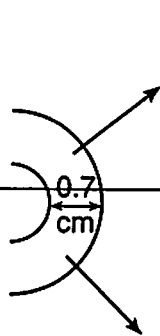


Wave fronts

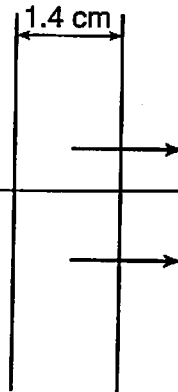
Which diagram represents the appearance of the wave fronts after passing through the opening in the barrier?



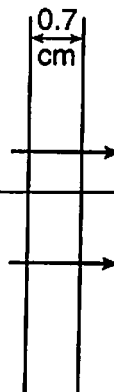
47 (1)



29 (2)

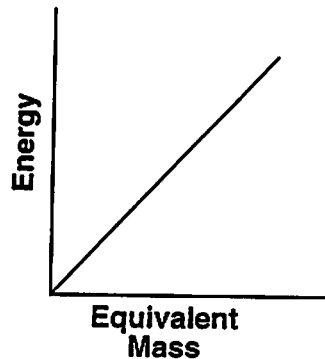


0 (3)



4 (4)

50 The graph below represents the relationship between energy and the equivalent mass from which it can be converted.



The slope of this graph represents

9 (1) c
52 (2) c^2

15 (3) g
4 (4) g^2