Part A

Answer all questions in this part.

Directions (1–35): For *each* statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the 2006 *Edition Reference Tables for Physical Setting/Physics.* Record your answers on your separate answer sheet.

1 Which combination correctly pairs a vector quantity with its corresponding unit?

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

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

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

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

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

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

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

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

(1) 15°
(2) 30.°
(3) 45°
(4) 75°

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

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

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

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

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

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

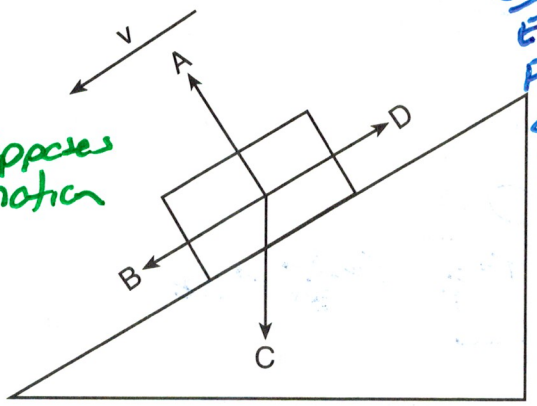
9 A golf club hits a stationary 0.050-kilogram golf ball with an average force of 5.0×10^3 newtons, accelerating the ball to a speed of 44 meters per second. What is the magnitude of the impulse imparted to the ball by the golf club?

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

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

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

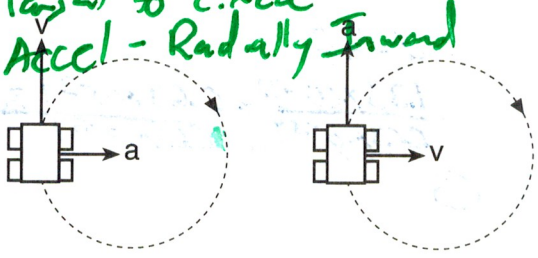
11 The diagram below represents a box sliding down an incline at constant velocity.



Which arrow represents the direction of the frictional force acting on the box?

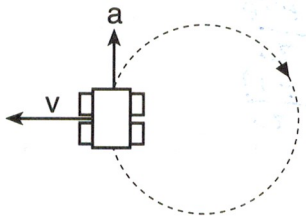
(1) *A*
(2) *B*
(3) *C*
(4) *D*

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

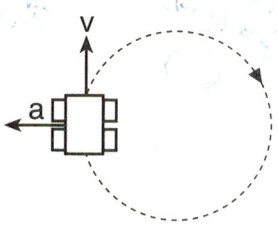


(1)

(3)



(2)



(4)

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

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

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

(1) $\frac{F_g}{m}$
(2) G
(3) mg
(4) $\frac{Gm_1m_2}{r^2}$

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

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

16 Which forces can be either attractive or repulsive?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

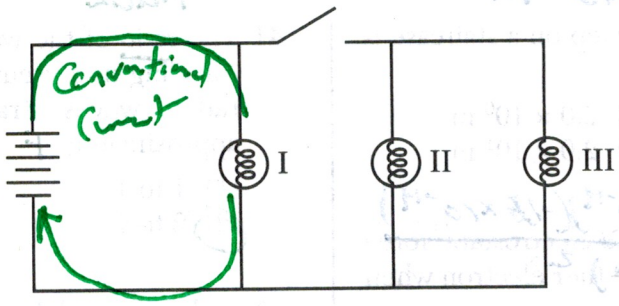
31 The energy equivalent of the rest mass of an electron is

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

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

(1) 10. N/m
(2) 17 N/m
(3) 25 N/m
(4) 50. N/m

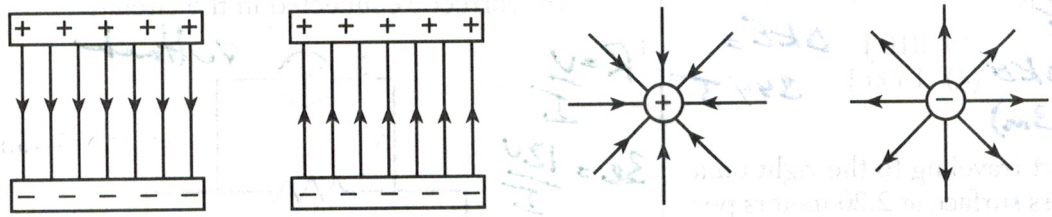
33 An electric circuit contains a battery, three lamps, and an open switch, as represented in the diagram below.



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

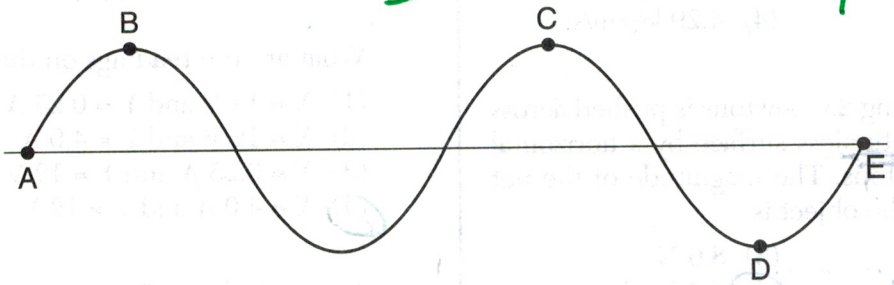
(1) lamp I, only
(2) lamps II and III, only
(3) lamps I, II, and III
(4) none of the lamps

34 Which diagram correctly represents an electric field?



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

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



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

Part B–1

Answer all questions in this part.

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

36 The height of an individual step on a staircase is closest to

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

37 What is the magnitude of the electrostatic force exerted on an electron by another electron when they are 0.10 meter apart?

(1) 2.6×10^{-36} N
(2) 2.3×10^{-27} N
(3) 2.3×10^{-26} N
(4) 1.4×10^{-8} N

38 After a 65-newton weight has fallen freely from rest a vertical distance of 5.3 meters, the kinetic energy of the weight is

(1) 12 J
(2) 340 J
(3) 910 J
(4) 1800 J

39 A 0.500-kilogram cart traveling to the right on a horizontal, frictionless surface at 2.20 meters per second collides head on with a 0.800-kilogram cart moving to the left at 1.10 meters per second. What is the magnitude of the total momentum of the two-cart system after the collision?

(1) 0.22 kg•m/s
(2) 0.39 kg•m/s
(3) 1.98 kg•m/s
(4) 4.29 kg•m/s

40 An object weighing 2.0 newtons is pushed across a horizontal, frictionless surface by a horizontal force of 4.0 newtons. The magnitude of the net force acting on the object is

(1) 0.0 N
(2) 2.0 N
(3) 8.0 N
(4) 4.0 N

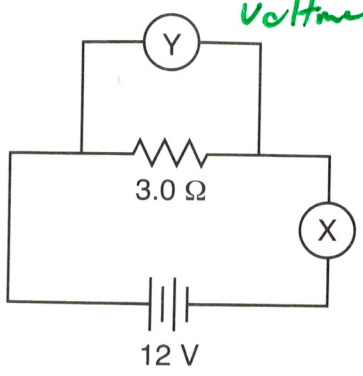
41 The ratio of the wavelength of AM radio waves traveling in a vacuum to the wavelength of FM radio waves traveling in a vacuum is approximately

(1) 1 to 1
2 to 1
(3) 10^2 to 1
(4) 10^8 to 1

42 A charm quark has a charge of approximately

(1) 5.33×10^{-20} C
(2) 1.07×10^{-19} C
(3) 1.60×10^{-19} C
(4) 2.40×10^{-19} C

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



What are the readings on the meters?

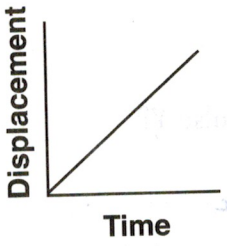
(1) *X* = 12 V and *Y* = 0.25 A
(2) *X* = 12 V and *Y* = 4.0 A
(3) *X* = 0.25 A and *Y* = 12 V
(4) *X* = 4.0 A and *Y* = 12 V

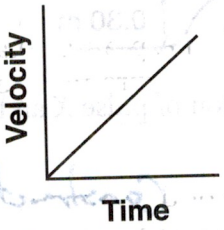
44 A toy airplane, flying in a horizontal, circular path, completes 10. complete circles in 30. seconds. If the radius of the plane's circular path is 4.0 meters, the average speed of the airplane is

(1) 0.13 m/s
(2) 0.84 m/s
(3) 1.3 m/s
(4) 8.4 m/s

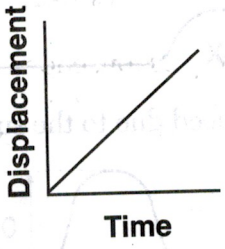
positive Accel

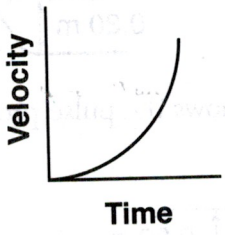
45 Which pair of graphs represents the vertical motion of an object falling freely from rest?





(1)





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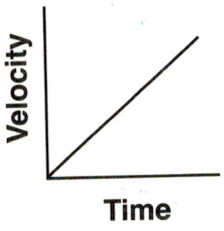

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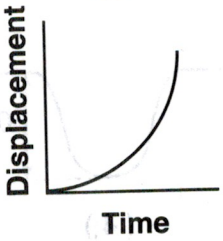
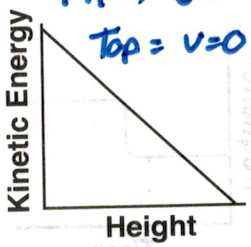


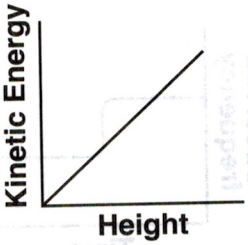
(4)

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

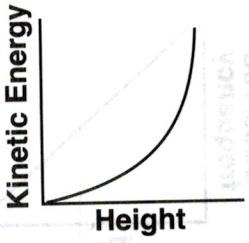
↑h → ↓v
Top = v=0



(1)



(2)



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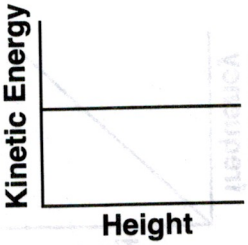
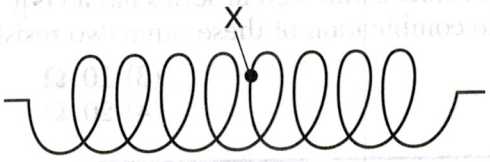


(4)

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



Longitudinal – Particles vibrate parallel to the direction of the wave

Which diagram represents the motion of particle X as a longitudinal wave passes through the spring toward the right?

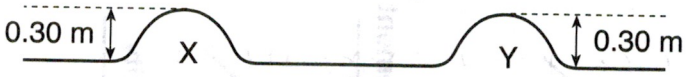
(1)

(2)

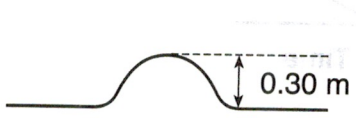
(3)

(4)

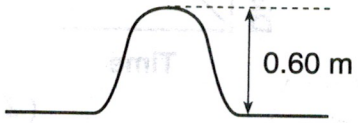
48 As represented in the diagram below, two wave pulses, X and Y, are traveling toward each other in a rope. Both wave pulses have an amplitude of 0.30 m.



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



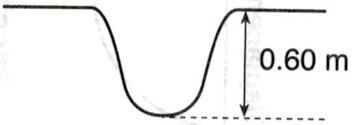
(1)



(3)

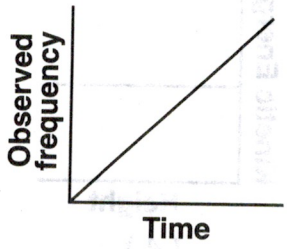
Constructive Interference

(2)

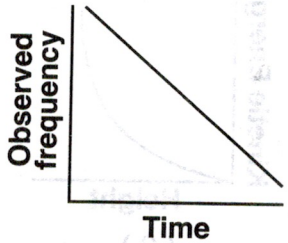


(4)

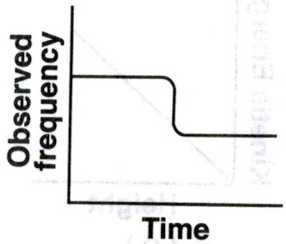
49 The horn of a car produces a sound wave of constant frequency. The car, traveling at constant speed, approaches, passes, and then moves away from a stationary observer. Which graph best represents the frequency of this sound wave detected by the observer during the time interval in which the car approaches,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



(1)



(2)



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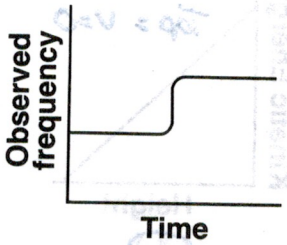


(4)

Doppler Effect Approach: ↑f (High) Depart ↓f (low)

50 A combination of two identical resistors connected in series has an equivalent resistance of 10. ohms. What is the equivalent resistance of the combination of these same two resistors when connected in parallel?

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

Series 5Ω 5Ω $R_T = 10\,\Omega$

Parallel $\frac{1}{R_T} = \frac{1}{5\Omega} + \frac{1}{5\Omega}$ $\frac{1}{R_T} = .4$ $R_T = 2.5\,\Omega$

x^{-1}

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

/35

PHYSICAL SETTING
PHYSICS

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

ANSWER BOOKLET

Student ... Key ...

Teacher ...

School ... Grade ...

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

Part B–2

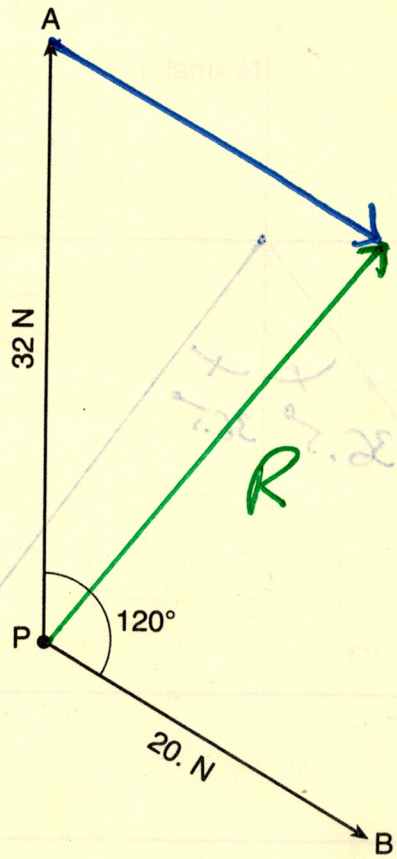
32N = 8cm
4N = 1cm

(4.0U ± .2N)

+1 **51** 1.0 cm = 4 N

52

+1 Construct Resultant and Label R



+2

+1 53 28 N

Resultant = 7cm
7cm × 4 = 28N
(Use scale from 51 and Magnitude of Length from 52)
(28 ± 2N)

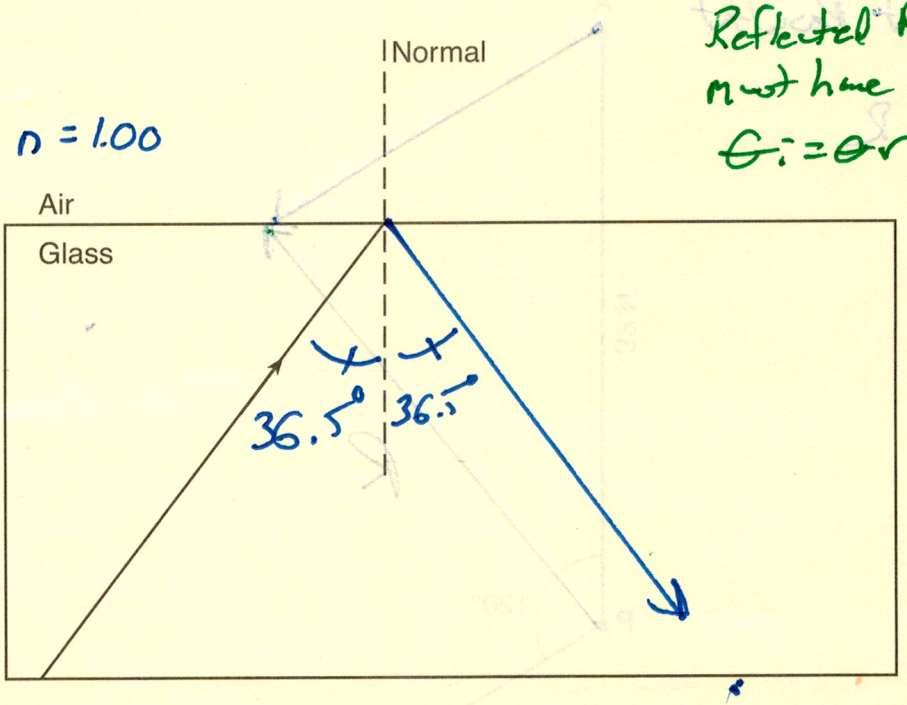
54–55

+2 W = F·d Fand d must be parallel
25N(.6m)
150 J

(Equation & Sub w/units)

+1 56 The work required would Increase

+1 57



Reflected Ray must have Arrow
θi = θr
(37° ± 2°)

(5)

+2

58–59

Given:

$I = 5.0\,A$

$t = 36\,s$

$q = ??$

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

$5.0\,A = \frac{q}{36\,s}$ (Eqn & Sub w/units)

$q = 180\,C$

+2

60–61

Given:

$k = 100\,\frac{N}{m}$

$PE_s = 2.0\,J$

$x = ??$

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

$2.0\,J = \frac{1}{2}\left(100\,\frac{N}{m}\right)x^2$

$\frac{2.0}{50} = \frac{50x^2}{50}$ (Eqn & Sub w/units)

$\sqrt{.04} = \sqrt{x^2}$

$x = .2\,m$

+4

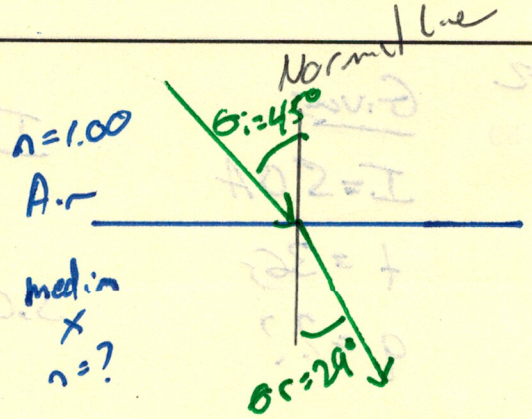
+2 **62–63**

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

$1.00 \sin 45° = n_2 \sin 29°$

$\frac{.7071}{\sin 29°} = \frac{n_2 \sin 29°}{\sin 29°}$

$n_2 = 1.45$



(Eqn & Sub w/ units)
must have degree sign

+2 **64–65**

Given

$\lambda = 488$ nanometers Prefixes of Powers of 10 (Eqn & Sub w/ units)

488×10^{-9} m

$E = ??$

$E = \frac{hc}{\lambda}$ $\quad E = \frac{6.63 \times 10^{-34} \text{ Js} \, (3.00 \times 10^{8} \text{ m/s})}{488 \times 10^{-9} \text{ m}}$

$E = \frac{1.989 \times 10^{-25}}{488 \times 10^{-9}} = 4.08 \times 10^{-19} \text{ J}$

use 488m by mistake

$E = \frac{6.63 \times 10^{-34} \text{ Js} \, (3 \times 10^{8} \text{ m/s})}{488 \text{ m}} = \frac{1.989 \times 10^{-25}}{488}$

(+4)

$E = 4.08 \times 10^{-28}$ J (Get 1 of 2 pts)

+2

Part C

66–67 Given

$L = .22\,m$

$R = 19\,\Omega$

$\rho = 5.60\times10^{-8}\,\Omega m$

$A = ??$

(Use Ω @ 20°C since Resistivities are given on Reference table @ 20°c)

$R = \frac{\rho L}{A}$ $\quad 19\,\Omega = \frac{(5.60\times10^{-8}\,\Omega m)(.22\,m)}{A}$

(Eqn & Sub w/units)

$\frac{19A}{19} = \frac{1.232\times10^{-8}}{19}$ $\quad A = 6.48\times10^{-10}\,m^2$

Must have m^2

+1

68 ↑ Temprature → ↑ R

+2

69–70

Given

$P = ??$

$v = 120V$

$R = 18\,\Omega$ (Use R fm 66-67)

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

$P = \frac{(120V)^2}{240\,\Omega}$ $\quad P = \frac{(120)^2}{240}$

$P = 60\,W$

(Eqn & sub w/units)

+5

Horizontal Force X-Dir

71–72 X-Case (Eqn & Sub w/ units)

$F_x = F\cos\theta$

$150N \cos 30°$

$F_x = 130N$

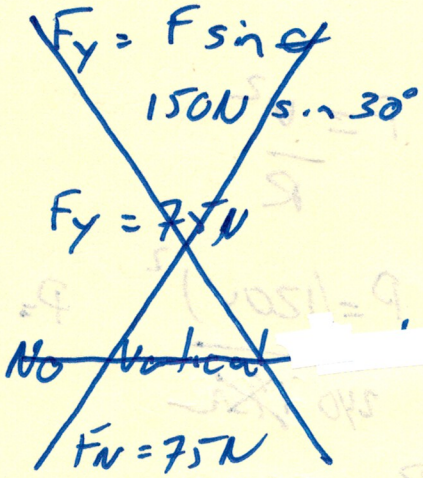
+1 73 130N N

Constant Velocity - Forces are equal

(see as 71-72)

$F_f = F_x$

+2 74–75



Wood Crate
Wood Floor
Constant Velocity
$\mu_K = .30$

Use F_f from 73

(Eqn & Sub w/ units)

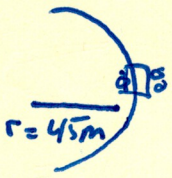
$F_f = \mu F_N$

$\frac{130N}{.30} = \frac{.30\,F_N}{.30}$

$F_N = 433N$

(F5)

+2 76–77



$m = 1500\,kg$

$a_c = 3.2\,m/s^2$

$a_c = \frac{v^2}{r}$ $\quad 3.2\,m/s^2 = \frac{v^2}{45\,m}$

$\sqrt{v^2} = \sqrt{144}$

$v = 12\,m/s$

(Eqn & Sub with +1)

$F_c = ma_c$

$1500\,kg\ (3.2\,m/s^2)$

+1 78 4800 N

+1 79 F_f or Electromagnetic Only

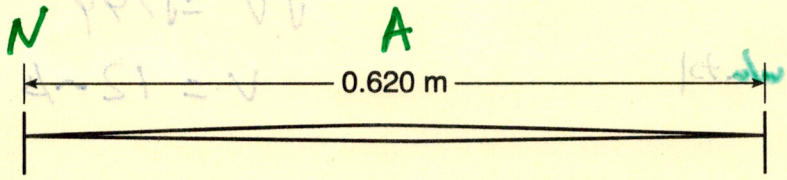
+1 80 Decrease F_c

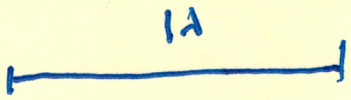
$F_c = \frac{mv^2}{r}$

(+5)

$\downarrow = \frac{-\downarrow}{-}$

+1 81 Label 1 Node & Anti-Node





+1 82 1.24m m

.620m = $\frac{1}{2}\lambda$

×2

+2 83–84

$f = 196\ Hz$

$\lambda = 1.24m$ (Or any answer from 82)

$v = f\lambda$

$= 196Hz\ (1.24m)$

$v = 243\ m/s$

+1 85 ↑ Freq

Shorter Vibrating Portion

↓ λ → ↑ Freq

+1

P.S./PHYSICS