# Honors Physics – Practice Final Exam

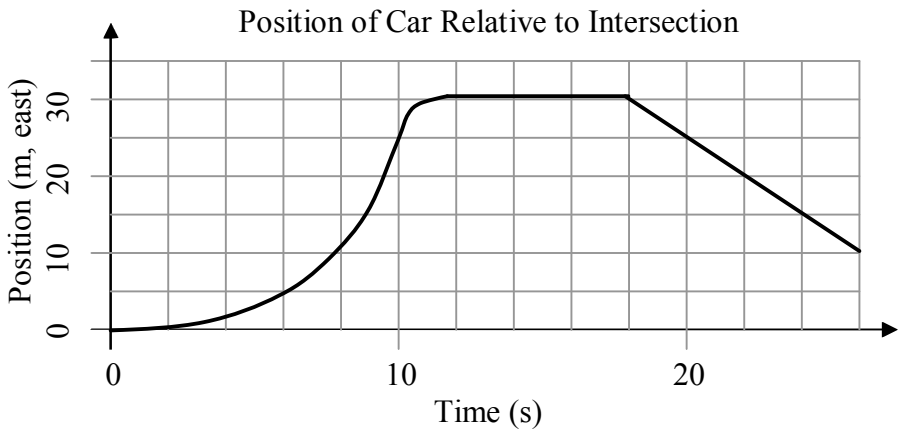
The following values may be used throughout the test whenever needed:

$G = 6.674 \times 10^{-11}\ \text{m}^3/\text{kg}\cdot\text{s}^2$ $k = 8.99 \times 10^{9}\ \text{N}\cdot\text{m}^2/\text{C}^2$
$c = 3.00 \times 10^{8}\ \text{m/s}$ $e = 1.602 \times 10^{-19}\ \text{C}$
$m_e = 9.11 \times 10^{-31}\ \text{kg}$ $m_p = 1.67 \times 10^{-27}\ \text{kg}$

1. Convert 65 cm into units of meters:
   A. 0.065 m B. 0.65 m C. 65 m D. 650 m
2. In an experiment to determine the value of *g* (freefall acceleration), a student produces a graph of speed vs. time for a falling object. The data forms a linear pattern with very little scattering (the points are all very close to the line of best fit). If the slope of this line is 11.0 $\text{m/s}^2$, what does this indicate about the data?
   A. The data is relatively accurate but not very precise
   B. The data is relatively precise but not very accurate.
   C. The data is both quite precise and quite accurate.
   D. The data is neither very precise nor very accurate.
3. An experiment is done to determine the speed of light. The experiment is repeated several times producing the following values: $2.5 \times 10^8$ m/s, $3.2 \times 10^8$ m/s, $3.1 \times 10^8$ m/s, $3.4 \times 10^8$ m/s, and $2.7 \times 10^8$ m/s, $2.9 \times 10^8$ m/s. The mean of these values is $3.0 \times 10^8$ m/s.
   A. There is significant random error but very little systematic error.
   B. There is significant systematic error but very little random error.
   C. Both random and systematic error are significant.
   D. There is very little error of any type.
4. A scientist adds two distances together, performing the calculation 9.62 m + 0.94 m. Which of the following results has the correct number of significant digits?
   A. 10.56 m B. 10.6 m C. 11 m D. 10 m
5. A physicist divides distance by time, performing the calculation 14.0 m ÷ 4.0 s. Which of the following results has the correct number of significant digits?
   A. 4 m/s B. 3.5 m/s C. 3.50 m/s D. 3.500 m/s
6. A car's odometer indicates the number of miles traveled by the car over the various roadways upon which it has been driven. This value would be described as what by a physicist?
   A. position B. displacement C. frequency D. distance
7. Which of the following quantities is <u>not</u> a vector?
   A. position B. displacement C. distance D. velocity
8. A boat traveling with constant speed 2.00 m/s takes how much time to move a distance of 2.50 m?
   A. 0.80 s B. 1.25 s C. 2.0 s D. 5.0 s
9. At a constant speed of 27.0 km/h how far will a car travel in 1.50 s?
   A. 11.3 m B. 40.5 m C. 146 m D. 675 m
10. What is the stopping distance of a car with initial speed 10.0 m/s that decelerates uniformly at a rate of 2.0 $\text{m/s}^2$?
    A. 5.0 m B. 25 m C. 50 m D. 75 m
11. A certain object moves 60.0 m northward in 12.0 s. It then immediately changes direction and moves 80.0 m westward in 5.00 s. Determine the average velocity of this object's motion – the result has a magnitude of
    A. 1.18 m/s B. 5.88 m/s C. 8.24 m/s D. 10.5 m/s

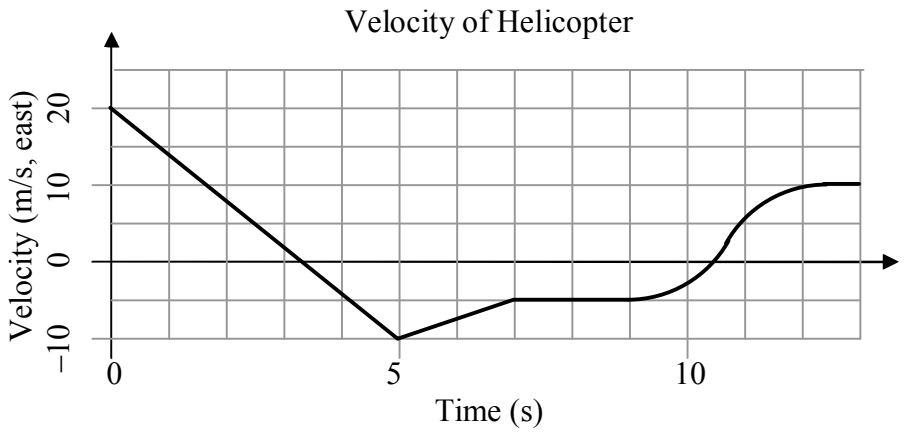
12. Starting from rest a cyclist attains a speed of 8.00 m/s over a distance of 12.0 m. Determine the rate of acceleration.
    A. 0.38 m/s$^2$ B. 2.67 m/s$^2$ C. 3.00 m/s$^2$ D. 5.33 m/s$^2$
13. A ball is thrown directly upward with initial speed 4.0 m/s. What is the velocity of the ball 0.50 s after this?
    A. 8.9 m/s upward B. 8.9 m/s downward C. 0.90 m/s upward D. 0.90 m/s downward
14. On a planet in a distant galaxy far, far away, an alien drops a rock off a cliff. The rock takes 10.0 s to fall 15.0 m straight down. Determine the value of $g$ on this alien world.
    A. 0.15 m/s$^2$ B. 0.30 m/s$^2$ C. 1.5 m/s$^2$ D. 3.0 m/s$^2$
15. The initial velocity of a certain object is 18.0 m/s, 0.0º as it accelerates 4.00 m/s$^2$, 180.0º for 9.00 s. Determine the distance traveled by this object during this time.
    A. 0.00 m B. 40.5 m C. 81.0 m D. 324 m
16. Suppose a graph of distance vs. time is constructed for a particular moving object. The data on this graph forms a parabola. At a particular point in time the instantaneous speed of the object equals which of the following?
    A. The quotient of distance over time for the coordinates at that point.
    B. The coefficient of the $t^2$ term in the parabolic curve fit.
    C. The slope of a line drawn tangent to the point in question.
    D. The area under the curve up to the point in question.

Questions 17 – 22 refer to the following graph:




17. What is the car's displacement from $t$ = 18 s to $t$ = 26 s?
    A. 10 m, east B. 20 m, west C. 16 m, west D. 160 m, east
18. Find the car's average speed for the entire graph.
    A. 0.38 m/s B. 1.0 m/s C. 1.9 m/s D. 2.5 m/s
19. The car's maximum speed would be closest to which of the following?
    A. 5 m/s B. 10 m/s C. 15 m/s D. 20 m/s
20. Find the car's speed at $t$ = 20.0 s.
    A. 1.00 m/s B. 1.25 m/s C. 2.50 m/s D. 25.0 m/s
21. During which of the following time intervals does the car's velocity point westward?
    A. 2 s < $t$ < 10 s B. 10 s < $t$ < 12 s C. 12 s < $t$ < 18 s D. 18 s < $t$ < 26 s
22. At which of the following points in time does the car's acceleration point westward?
    A. $t$ = 4 s B. $t$ = 11 s C. $t$ = 15 s D. $t$ = 20 s

Questions 23 – 27 refer to the following graph:




23. During which of the following intervals of time is the helicopter's speed increasing?
A. 0 s < $t$ < 3 s B. 4 s < $t$ < 5 s C. 5 s < $t$ < 7 s D. 7 s < $t$ < 9 s
24. The magnitude of the helicopter's acceleration is decreasing at which of the following points in time?
A. $t$ = 2s B. $t$ = 6 s C. $t$ = 10 s D. $t$ = 11 s
25. Find the magnitude of the helicopter's acceleration at $t$ = 6 s.
A. 0.40 m/s$^2$ B. 0.50 m/s$^2$ C. 1.25 m/s$^2$ D. 2.50 m/s$^2$
26. What is the direction of the helicopter's acceleration at $t$ = 6 s?
A. east B. west C. north D. south
27. Determine the distance traveled by the helicopter during the interval of time from $t$ = 5 s to $t$ = 9 s.
A. 20.0 m B. 25.0 m C. 30.0 m D. 35.0 m

28. An airplane flies with velocity 400.0 km/h, 140.0º (40.0º north of west). Which of the following are the components of this velocity? (Assume positive $x$ = east and positive $y$ = north.)
A. $v_x$ = – 306 km/h, $v_y$ = 257 km/h C. $v_x$ = 306 km/h, $v_y$ = – 257 km/h
B. $v_x$ = – 257 km/h, $v_y$ = 306 km/h D. $v_x$ = – 257 km/h, $v_y$ = 306 km/h
29. An inclined railroad moves upward along a track that forms an angle of 25.0º with the horizontal. The speed of the railroad decreases at rate 2.00 m/s per second. Determine the vertical component of the train's acceleration.
A. 0.845 m/s$^2$ B. – 0.845 m/s$^2$ C. 1.81 m/s$^2$ D. – 1.81 m/s$^2$
30. Find the resultant of the two vectors: 10.0 m, 45.0º and 5.00 m, 270.0º.
A. 5.00 m, 45.0º B. 7.37 m, 16.3º C. 7.37 m, 73.7º D. 14.0 m, 59.6º
31. An airplane has groundspeed 250 km/h on a northward course while encountering a southward wind of 20.0 km/h. Determine the airspeed and heading of the airplane.
A. 230 km/h, north B. 230 km/h, south C. 270 km/h, north D. 270 km/h, south
32. Relative to earth the cruise ship has velocity 5.0 m/s, east. Eduardo saunters with velocity 1.5 m/s, southward relative to the deck of the ship. What is the velocity of Eduardo relative to earth?
A. 3.5 m/s, east B. 3.5 m/s, north C.5.2 m/s, 17º south of east D. 6.5 m/s, 17º south of east
33. In order to proceed due east (0.0º) in a wind of 40.0 km/h south (270º), what must be the heading of an aircraft with airspeed 150.0 km/h?
A. 14.9º B. 15.5º C. 344.5º D. 345.1º
34. An arrow is fired horizontally from a height of 1.50 m above a horizontal field. The arrow lands 25.0 m away in the field. Find the speed with which the arrow was fired.
A. 25.0 m/s B. 45.2 m/s C. 50.6 m/s D. 63.9 m/s

35. A football is kicked with velocity 16.0 m/s, 40.0º. How far does it travel over level ground before hitting?
    A. 12.9 m  B. 20.0 m  C. 25.7 m  D. 51.5 m
36. A baseball is hit and flies from home plate to the second baseman. At the instant when the ball reaches its highest point above the field, which of the following would be true of its velocity and acceleration? Ignore the effect of air resistance.
    A. Velocity and acceleration are both equal to zero.
    B. The *y*-component of velocity and the *y*-component of acceleration are both equal to zero.
    C. The *x*-component of velocity and the *y*-component of acceleration are both equal to zero.
    D. The *y*-component of velocity and the *x*-component of acceleration are both equal to zero.
37. Object A is twice the mass of object B. Both objects are dropped off a cliff and fall under the sole influence of earth's gravity near its surface. Compare the acceleration of A to the acceleration of B.
    A. Acceleration of A is four times that of B.
    B. Acceleration of A is twice that of B.
    C. Acceleration of A is half that of B.
    D. Acceleration of A is equal to that of B.
38. A student exerts a force on a book in order to carry it. Let $F_1$ = amount of force student must exert to hold the book at rest, $F_2$ = amount of force student must exert to raise the book at constant velocity, $F_3$ = amount of force student must exert to move the book horizontally with constant velocity. Compare these three values, assuming the only other force on the book is gravity.
    A. $F_1 = F_2 = F_3$  B. $F_1 = F_3 < F_2$  C. $F_1 = F_2 > F_3$  D. $F_2 > F_1 > F_3$
39. A book rests upon the top of a table. The gravity acting on the book is 15 N downward. If this is the "action", what is the "reaction", according to Newton's 3rd Law of Motion?
    A. The table exerts a force of 15 N upward on the book.
    B. The book exerts a force of 15 N downward on the table.
    C. The book exerts a force of 15 N upward on the table.
    D. The book exerts a force of 15 N upward on the Earth.
40. A net force of magnitude 0.50 N acts of an object with mass 250 grams. The magnitude of the object's acceleration is:
    A. 0.0020 m/s$^2$  B. 0.125 m/s$^2$  C. 0.50 m/s$^2$  D. 2.0 m/s$^2$
41. A bricklayer lifts a brick of mass 2.7 kg and accelerates it upward at 3.0 m/s$^2$. What is the magnitude of the force that the bricklayer exerts on the brick?
    A. 8.10 N  B. 18.4 N  C. 26.5 N  D. 34.6 N
42. What is the mass of an object that weighs 25 N?
    A. 2.45 kg  B. 2.55 kg  C. 25 kg  D. 245 kg
43. A box of weight 30.0 N is pushed across a level floor by an applied force of 20.0 N. If the coefficient of friction is 0.15, what is the resulting acceleration of the box?
    A. 0.52 m/s$^2$  B. 4.6 m/s$^2$  C. 5.1 m/s$^2$  D. 6.5 m/s$^2$
44. A downward force of 10.0 N is exerted on a baseball of mass 0.145 kg. Determine the time for the baseball to accelerate from rest to a speed of 20.0 m/s as a result of this action.
    A. 0.254 s  B. 0.290 s  C. 2.04 s  D. 3.94 s
45. When a driver takes her foot off the gas and applies the brakes there is a frictional force that acts "backward" to slow the car. What can be said correctly about "forward" force(s) acting on the car as it moves forward over level pavement and slows down?
    A. The amount of forward force is greater than zero but less than the amount of frictional force.
    B. The amount of forward force is equal to the amount of frictional force.
    C. The amount of forward force is greater than zero but less than the amount of frictional force.
    D. The amount of forward force is zero.

46. An army commando is lowered by rope from a hovering helicopter to the ground. If the commando moves downward at a constant speed, what can be said of the tension in the rope?
A. The tension in the rope will be greater than the commando's weight.
B. The tension in the rope will be equal to the commando's weight.
C. The tension in the rope will be less than the commando's weight.
D. The tension in the rope will equal the sum of the commando's weight plus inertia.

47. A block of mass 10.0 kg rests upon a ramp where the coefficient of static friction is 0.45. The ramp is inclined 20.0º relative to horizontal. A rope parallel to the surface is used to pull the block up the ramp. What is the minimum tension in the rope that will start the block moving?
A. 7.92 N B. 10.6 N C. 75.0 N D. 77.6 N

48. A 300.0 N crate is dragged across a level floor at a constant velocity by a rope that forms an angle of 60.0º with the floor. If the tension in the rope is 150 N what is the coefficient of friction?
A. 0.25 B. 0.44 C. 0.50 D. 0.58

49. An object moves at constant speed along a circular path. Which of the following correctly describes the force(s) acting on such an object?
A. The net force is directed toward the center of the circle.
B. The net force is directed directly away from the center of the circle.
C. The net force is directed tangent to the circle.
D. Although there must be a force toward the center there must also be a force away from the center.

50. A kid twirls a yo-yo of mass 0.100 kg in a circle on the end of its string that is 0.60 m long. If the yo-yo completes 10.0 revolutions every 4.00 s, what is the tension in the string. Ignore gravity and air resistance.
A. 0.38 N B. 1.1 N C. 2.4 N D. 15 N

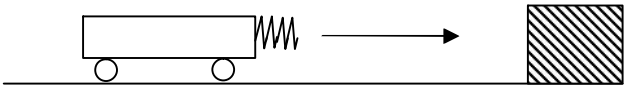
51. A car's cornering ability is tested by driving it around a level circular track with radius 45.0 m. If the car's maximum speed on the track is 20.0 m/s (beyond which it skids), what is the coefficient of static friction?
A. 0.144 B. 0.444 C. 0.907 D. 1.10

52. A certain rollercoaster has a vertical loop with radius 5.0 m. In order that the people riding the rollercoaster do not come out of their seats at the top of the loop, what is the minimum speed at that point?
A. 0 m/s B. 7.0 m/s C. 44 m/s D. 49 m/s

53. A small lead mass of 0.100 kg swings back and forth freely on the end of a string of length 1.50 m. The string of the pendulum swings 40.0º on either side of vertical. Find the maximum speed of the mass on the end of the string.
A. 1.70 m/s B. 2.62 m/s C. 4.35 m/s D. 4.75 m/s

54. A ball of mass 2.00 kg is launched straight up with kinetic energy equal to 100.0 J. What is the maximum height to which it will travel above its launch point?
A. 5.10 m B. 15.3 m C. 50.0 m D. 510 m

55. A spring with constant $k$ = 600.0 N/m is attached to the front end of a lab cart as shown below. The cart and spring, total mass 1.60 kg roll at speed 3.00 m/s until the spring hits the barrier. What will be the maximum rate of acceleration as the cart bounces off the barrier (which does not move)?



A. 33.5 m/s$^2$ B. 41.1 m/s$^2$ C. 58.1 m/s$^2$ D. 375 m/s$^2$

56. A kid throws a 0.500 kg rock straight up by applying a constant upward force of 80.0 N as the rock is lifted 1.20 m and release. Find the kinetic energy of the rock at the instant it is released.
A. 19.0 J B. 90.1 J C. 96.0 J D. 102 J

57. Which of the following is a nonconservative force?
A. gravity B. a spring's force C. electrostatic force D. friction

58. A joule of energy is equivalent to which of the following combination of units?
A. kg m/s B. kg $m/s^2$ C. kg $m^2/s^2$ D. kg $m^2/s^3$

59. A certain light bulb has power input 75 W and creates light with efficiency 25%. Determine the time for it to emit 100 J of light energy.
A. 0.19 s B. 0.33 s C. 1.8 s D. 5.3 s

60. In order for the total momentum of two colliding objects to remain constant, which of the following must be true?
I. It must be a perfectly elastic collision.
II. There must be no internal forces.
III. There must be no net external force.
A. only I and III B. only I and II C. only II and III D. only III

61. An object of mass 20.0 kg and initial velocity 10.0 m/s, 0.0º is subject to a certain force that acts for a certain period of time. The final velocity of the object is 5.00 m/s, 90.0º. What is the magnitude of the net impulse that acts on the object, causing this change?
A. 100 Ns B. 223 Ns C. 300 Ns D. 750 Ns

62. Fuel is burned at a rate of 1200 kg/s by a certain rocket engine. The exhaust gases leave the nozzle of the rocket engine with speed 2100 m/s. What is the thrust of such a rocket engine?
A. 1.8 N B. 2.5 MN C. 53 MN D. 2.6 GN

63. Two asteroids undergo an inelastic collision in deep space, far away from any other objects. *Before* the collision the two asteroids have: total momentum equal to 2500 kg m/s and total kinetic energy equal to 3.3 MJ. Immediately *after* the collision, which of the following would be true of these totals?
A. total momentum = 2500 kg m/s; total kinetic energy = 3.3 MJ
B. total momentum = 2500 kg m/s; total kinetic energy < 3.3 MJ
C. total momentum < 2500 kg m/s; total kinetic energy = 3.3 MJ
D. total momentum < 2500 kg m/s; total kinetic energy < 3.3 MJ

64. A glass rod becomes positively charged when rubbed by a silk cloth. Which of the following explains how this occurs and what happens to the silk?
A. Electrons are removed from the rod and the silk becomes positively charged.
B. Electrons are removed from the rod and the silk becomes negatively charged.
C. Protons are transferred from silk to the rod and the silk becomes positively charged.
D. Protons are transferred from silk to the rod and the silk becomes negatively charged.

65. A negatively charged particle is located a distance $d$ from a second negatively charged particle. What happens to the electrostatic force between the two particles if the separation is doubled so that the particles are now a distance $2d$ apart?
A. The force is one fourth its original value.
B. The force is one half its original value.
C. The force is unchanged from its original value.
D. The force is twice its original value.

66. A pith ball of charge +2.5 nC is located 3.0 m to the left of a small sphere with charge – 4.0 nC. Find the force that acts on the pith ball.
A. $1.0 \times 10^{-8}$ N, right B. $1.0 \times 10^{-8}$ N, left C. $3.0 \times 10^{-8}$ N, right D. $3.0 \times 10^{-8}$ N, left

67. Three point charges, each equal to $q$, are located at the vertices of an equilateral triangle with sides of length $L$. Determine the magnitude of the net force that acts on one of these charges in terms of $k$, the electrostatic constant (*i.e.* the Coulomb's Law constant).
A. $\frac{2kq}{L^2}$ B. $\frac{kq^2}{L^2}$ C. $\frac{\sqrt{3}kq^2}{2L^2}$ D. $\frac{\sqrt{3}kq^2}{L^2}$

68. A point charge of 8.0 nC produces an electric field that surrounds it. At what distance from this point charge would the electric field strength equal 8.0 N/C?
A. 0.33 m B. 3.0 m C. 9.0 m D. 95 m

69. A point charge of +12 nC is located on the *x*-axis at coordinates (0.30 m, 0). A second point charge of −8.0 nC is located on the *y*-axis at coordinates (0, 0.20 m). Determine the magnitude of the net electric field at the origin (0, 0) of this coordinate system. The result is closest to:
A. 600 N/C B. 650 N/C C. 2200 N/C D. 3000 N/C

70. An electron is accelerated away from a negatively charged metal plate and toward a positively charged metal plate that is parallel to the first plate. The potential difference between the two plates is 6.0 V. What is the change in the electron's kinetic energy as it moves from one plate to the other?
A. $2.7 \times 10^{-20}$ J B. $9.6 \times 10^{-19}$ J C. 6.0 J D. $1.5 \times 10^{6}$ J

71. A proton is initially at rest in a uniform electric field of 22 kN/C. In how much time will it have been displaced by 0.10 m by this field, assuming other forces are negligible?
A. $4.9 \times 10^{-26}$ s B. $4.7 \times 10^{-14}$ s C. $2.2 \times 10^{-7}$ s D. $3.1 \times 10^{-7}$ s

72. A certain fuse is rated at 25 amperes. Based on this value, what is the maximum amount of charge that can pass through the fuse in 5.0 s?
A. 0.20 C B. 5.0 C C. 20 C D. 125 C

73. If the conventional positive current in a certain schematic diagram is directed to the right, what does this mean about the actual wire that the diagram represents?
A. Electrons within the wire are moving to the right.
B. Electrons within the wire are moving to the left.
C. Protons within the wire are moving to the right.
D. Protons within the wire are moving to the leftt.

74. Current in amount 2.0 A flows through a certain resistor when it is attached to a 3.0 V battery. What is the resistance of this resistor?
A. 0.67 Ω B. 1.0 Ω C. 1.5 Ω D. 6.0 Ω

75. A certain bulb has power equal to 25.0 W when connected to a 12.0 V battery. What current passes through the bulb?
A. 0.17 A B. 0.48 A C. 2.1 A D. 5.8 A

76. How much heat energy is given off by a resistor of 10.0 Ω in 10.0 s if it carries a current of 10.0 A?
A. 10̲0 J B. 1.0 kJ C. 10.0 kJ D. 10̲0 kJ

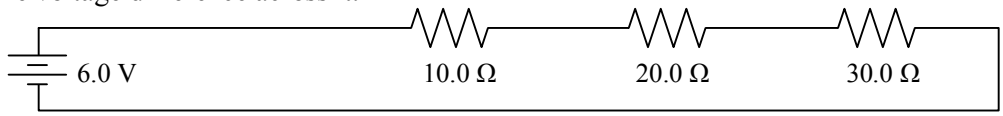
77. Three 1.5 V cells are stacked in series within a certain flashlight. Which of the following correctly describes the voltage and current for the bulb in this flashlight when it is turned on?
A. The bulb's voltage is 4.5 V
The current through each cell is the same as the current through the bulb.
B. The bulb's voltage is 4.5 V
The current through the bulb is three times the current through one of the cells.
C. The bulb's voltage is 1.5 V
The current through each cell is the same as the current through the bulb.
D. The bulb's voltage is 1.5 V
The current through the bulb is three times the current through one of the cells.

78. Two resistors, A and B, are connected parallel to one another and are a part of a DC circuit that is in operation. Resistor A is twice the resistance of resistor B. Which of the following is true?
A. The voltage of resistor A is twice the voltage of resistor B.
B. The voltage of resistor A is equal to that of resistor B.
C. The current of resistor A is twice the current of resistor B.
D. The current of resistor A is equal to that of resistor B.

79. Two resistors of values 68 Ω and 47 Ω are connected in series. The combination is equivalent to a single resistor with value:
A. 21 Ω B. 28 Ω C. 115 Ω D. 3200 Ω

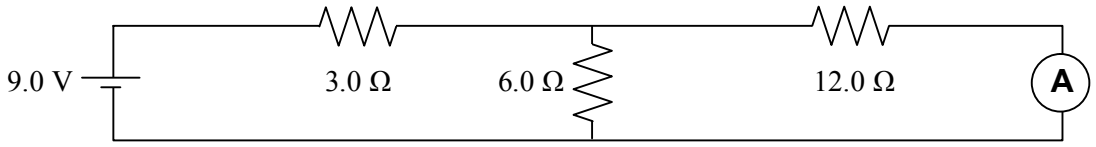
80. A certain pair of resistors connected in parallel has an effective resistance of 10.0 Ω. If one of these resistors is 12.0 Ω, what is the resistance of the other?
A. 60.0 Ω B. 8.00 Ω C. 0.0167 Ω D. −2.00 Ω

81. Three resistors of values 10.0 Ω, 20.0 Ω, and 30.0 Ω are connected in series and powered by a 6.0 V battery as shown below. For <u>just</u> the 10.0 Ω resistor, determine the current that passes through it and the voltage difference across it.




A. 0.60 A, 6.0 V B.0.60 A, 1.0 V C. 0.10 A, 6.0 V D. 0.10 A, 1.0 V

82. Examine the circuit shown below and determine the value indicated by the meter.




A. 0.43 A B. 0.60 A C. 0.86 A D. 1.3 A

83. When a sound wave passes from air into water, which of the following would <u>not</u> change?
A. amplitude B. wavelength C. speed D. frequency

84. A laser pointer is shone down into a lake. The light from the laser pointer goes from the air into the water. Which of the following correctly describes the change in the light as it enters the water?
A. Speed and wavelength both decrease.
B. Speed and frequency both decrease.
C. Wavelength and frequency both increase.
D. Speed decrease and wavelength increases.

85. A certain wave has wavelength 2.0 m and undergoes one complete cycle in 0.10 s. What is the speed of this wave?
A. 0.20 m/s B. 1.9 m/s C. 2.1 m/s D. 20 m/s

86. A certain radio transmitter broadcasts at wavelength 3.0 m. What is the frequency of this radio wave?
A. 10 nHz B. 110 Hz C. 100 MHz D. 900 MHz

87. Which of the following describes sound?
A. Sound is a longitudinal wave consisting of crests and troughs.
B. Sound is a longitudinal wave consisting of compressions and rarefactions.
C. Sound is a transverse wave consisting of crests and troughs.
D. Sound is a transverse wave consisting of compressions and rarefactions.

88. A sound wave with amplitude 0.10 mPa and wavelength 2.0 m occurs in the same air as a second sound wave with amplitude 0.30 mPa and wavelength 2.0 m. If the two waves are in phase and travel in the same direction what is the amplitude and wavelength of the superposition?
A. 0.40 mPa, 2.0 m B. 0.20 mPa, 2.0 m C. 0.40 mPa, 4.0 m D. 0.20 mPa, 4.0 m

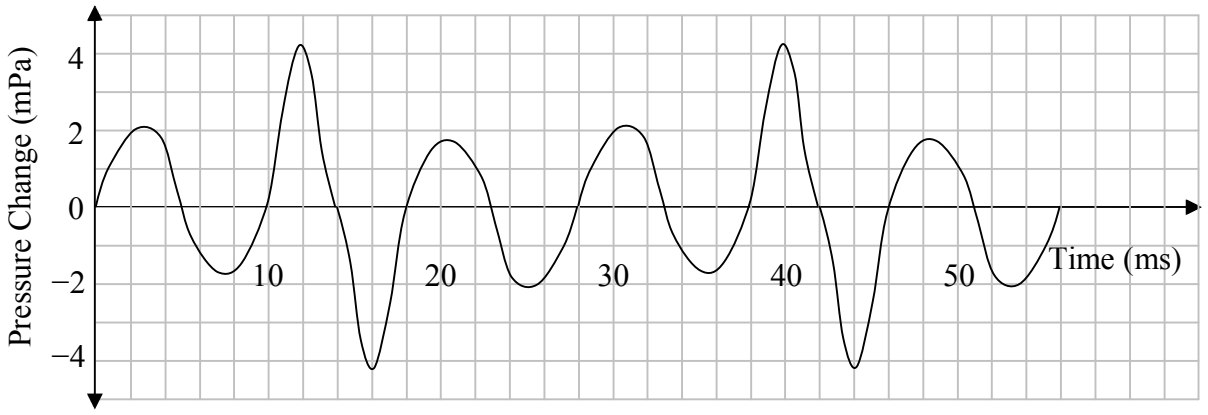
89. The length of a certain pipe is 0.70 m and it is open at both ends. What is the lowest frequency tuning fork that will resonate with the pipe? Use speed of sound 350 m/s.
A. 125 Hz B. 250 Hz C. 500 Hz D. 750 Hz

90. A standing wave is formed in an elastic cord such that a node is 0.10 m away from an adjacent antinode. If the frequency of this standing wave is 80.0 Hz, what is the speed of waves in the cord?
A. 8.0 m/s B. 16 m/s C. 32 m/s D. 800 m/s

91. Transverse waves within the string of a certain musical instrument have speed 210 m/s. The 3$^{rd}$ harmonic frequency of this string is 330 Hz. What is the length of the string?
A. 0.21 m B. 0.64 m C. 0.96 m D. 1.9 m

92. What occurs at a node in a standing wave?
    A. Waves are out of phase and destructive interference occurs.
    B. Waves are out of phase and constructive interference occurs.
    C. Waves are in phase and destructive interference occurs.
    D. Waves are in phase and constructive interference occurs.

Questions 93 – 98 refer to a sound wave with speed 340 m/s that is graphed below:




93. The amplitude of the wave is closest to which of the following?
    A. 1.7 mPa  B. 2.1 mPa  C. 4.2 mPa  D. 8.4 mPa
94. The frequency of this wave is closest to which of the following?
    A. 28 Hz  B. 36 Hz  C. 56 Hz  D. 100 Hz
95. The wavelength of this wave is closest to which of the following?
    A. 3.4 m  B. 6.1 m  C. 9.5 m  D. 12 m
96. If $t = 12$ ms is taken to be the beginning of a cycle then the next cycle begins at what point in time?
    A. $t = 16$ ms  B. $t = 20$ ms  C. $t = 26$ ms  D. $t = 40$ ms
97. Two loudspeakers create the same sound wave with wavelength 0.50 m. The two speakers move in phase with one another. Now suppose a microphone is placed at a point such that it is 1.60 m from one speaker and 2.35 m from the other. What occurs at the microphone?
    A. Constructive interference and a relatively loud sound occur at the microphone.
    B. Destructive interference and a relatively soft sound occur at the microphone.
    C. Neither constructive nor destructive interference occurs at the microphone.
    D. Either type of interference would be possible, depending on the speed of the sound.
98. Monochromatic light falls upon two slits separated by a distance of $2.0 \times 10^{-5}$ m. This results in bright lines appearing on a screen located 2.0 m from the slits. The 1st order bright line is 6.0 cm away from the central bright line. What is the wavelength of this light?
    A. $6.7 \times 10^{-4}$ m  B. $1.9 \times 10^{-5}$ m  C. $3.0 \times 10^{-7}$ m  D. $6.0 \times 10^{-7}$ m
99. When light passes through a narrow slit it bends around the edges of the opening. The slit becomes in essence a point source, with light emerging from it in all directions. This phenomenon is called
    A. reflection  B. refraction  C. diffraction  D. dispersion
100. Light of wavelength 555 nm falls upon a grating with 575 lines per millimeter. Determine the angle between the 1st and 2nd order bright lines that occur.
    A. 18.6º  B. 21.1º  C. 39.7º  D. 74.8º

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