SECOND YEAR PHYSICS TEST - JANUARY 2013

DIRECTIONS: Please PRINT your name, school, area, and which test you are taking on the scantron answer sheet/card. For each statement or question, completely fill in the appropriate space on the answer sheet. Use the letter preceding the word or phrase or sketch which best completes the statement or answers the question. Each question is worth 4 points. Use 9.8 m/s^2 as the value of the acceleration due to gravity. Unless otherwise stated, assume ideal conditions including no friction with the air. Figures are not to scale.

The following description is to be used for questions 1 through 3.

1-3. Given a 1,000 kg automobile and a 3,000 kg truck. The magnitude of the momentum of the two vehicles is the same. The automobile is traveling at 9.0 m/s.

1. The speed of the truck is ___ m/s.

A) 0.3 B) 0.6 C) 3.0 D) 6.0 E) 9.0

2. If the two vehicles were traveling at 90 degrees to each other and had a collision in which they stuck together, their speed as a result of the collision would have been ___ m/s.

A) 12.0 B) 6.0 C) 4.5 D) 3.9 E) 3.2

3. If initially, the kinetic energy of the two vehicles had been equal, instead of the momentum, then the truck speed would have been ___ m/s.

A) 6.0 B) 5.2 C) 3.0 D) 1.7 E) 0.2

The following description is to be used for questions 4 and 5.

4-5. Given a 0.1 kg point mass that is projected horizontally at 4.0 m/s . It descends 5.0 m before it strikes the ground.

4. The speed of the point mass when it strikes the ground is ___ m/s .

A) 10.7 B) 9.9 C) 8.0 D) 4.7 E) 4.0

5. When it was projected, the kinetic energy of the point mass was approximately times its potential energy relative to the ground below.

A) 0.2 B) 0.5 C) 1.0 D) 1.5 E) 6

6. Given a 0.200 kg point mass that is released from rest at a height of 10.0 m above the ground. The speed of the mass when it has fallen half-way to the ground is ___ times its speed when it hits the ground.

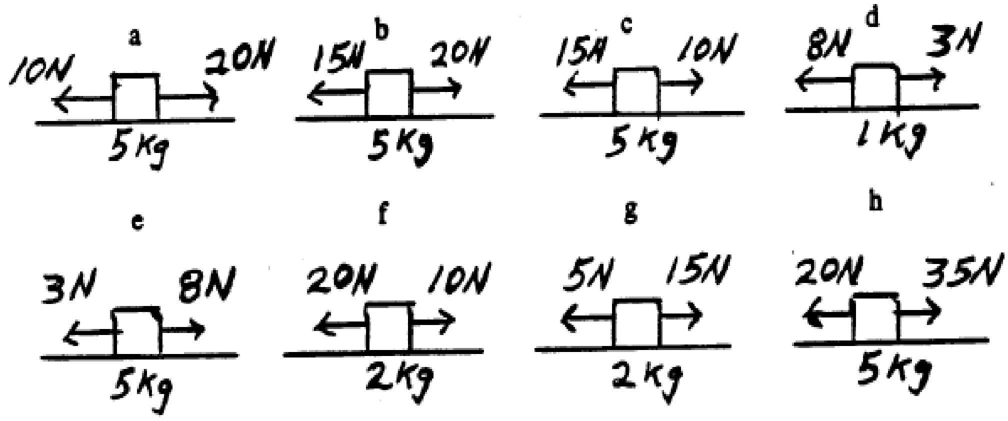
A) 0.14 B) 0.20 C) 0.45 D) 0.50 E) 0.71

7. Two forces are applied to a 2.0 kg object which is initially at rest on a horizontal frictionless surface. The forces are 20.0 N and 10.0 N . They are at a right-angle. The magnitude of the resulting acceleration of the object is ___ m/s^2 .

A) 15.0 B) 14.1 C) 11.2 D) 10.1 E) 9.9

The following figure and description are used for questions 8 and 9.

8-9. The eight figures below represent eight blocks. Blocks a, b, c, e, and h have masses of 5 kg each. Blocks f and g have masses of 2 kg each. Block d has a mass of 1 kg. The blocks are on a horizontal frictionless surface. At time equals zero, the eight blocks are moving to the right at 10.0 m/s. Neglect friction with the air. A pair of forces as indicated in the figures is applied to each block at time zero. The forces continue for 5.0 seconds.



8. When the time is 5.0 seconds, the block with the largest speed is block ___ .

A) a B) d C) f D) g E) h

9. Rank order the blocks on the basis of the magnitude of the linear momentum of each block when the time is 5.0 seconds. Rank order in descending order with the largest first. Use the equals sign, = , to indicate a tie in the ranking.

A) a, b, c, e, h, f, g, d

B) h, a, b=e, g, f, c, d

C) d, f=g, a=b=c=e=h

D) d=f=g, h, a, b=c=e

E) none of the choices are correct

10. A person wants to cross a stream of water. He is using a boat which has a maximum speed of 8.0 m/s relative to the water. The person wants to reach the shore 10.0 m further downstream from where the boat is launched. The downstream speed of the water is 6.0 m/s . The stream is 50.0 m wide.

To achieve this, with the boat at maximum speed the person heads the boat ___ .

A) straight toward the other side of the stream

B) 30 degrees downstream

C) 45 degrees downstream

D) 60 degrees downstream

E) none of these choices

11. It is possible that two vectors of magnitude 8.0 and 3.0 can be added so as to produce a third vector of magnitude ___ .

A) 15 B) 12 C) 8.0 D) 3.0 E) none of these choices

The following description is to be used for questions 12 and 13.

12-13. Given a 100.0 N block. It is at the low end of a plane. The plane is inclined at 30.0 degrees with the horizontal. The block starts at the low end at a speed of 10.0 m/s and continues up the plane 7.4 m along the plane until it comes to a stop. It slides 7.4 m back down the plane.

12. The coefficient of kinetic friction is ___ .

A) 0.18 B) 0.20 C) 0.22 D) 0.24 E) 0.26

13. The speed of the block when it returns to its starting point is ___ m/s .

A) 10.0 B) 8.7 C) 7.4 D) 6.7 E) 5.0

The following table and description are used for ques. 14 -17.

14-17 . Given a table of the velocity (in m/s) vs. time (in seconds) for the rectilinear motion of a 4.0 kg mass over a 5.0 s time interval. The mass was at the zero mark moving at 2.0 m/s when the time was zero.

Time (s)	Velocity (m/s)
0.0	2.00
0.50	2.00
1.0	3.00
1.5	5.00
2.0	8.00
2.5	12.0
3.0	17.0
3.5	23.0
4.0	30.0
4.5	38.0
5.0	47.0

14. The average acceleration of the 4.0 kg mass for the 5.0 second interval was approximately ___ m/s^2.

A) 9.8 B) 9.0 C) 8.6 D) 8.2 E) 7.8

15. When the time was 3.8 seconds, the velocity of the mass was approximately ___ m/s .

A) 23.9 B) 25.2 C) 26.0 D) 27.1 E) 28.0

16. When the time was 4.0 seconds, the kinetic energy of the mass was ___ J . A) 18,000 B) 1800 C) 900 D) 450 E) 420

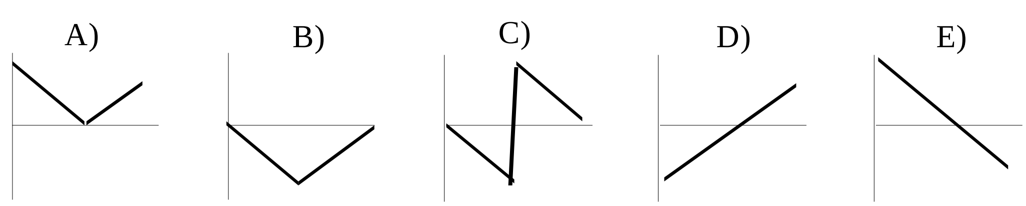
17. Of the five time intervals indicated, the maximum force on the mass occurred when the time interval was ___ seconds.

A) 0.5-1.0 B) 1.5 – 2.0 C) 2.5-3.0
D) 3.5-4.0 E) 4.5-5.0

The following figures and description are used for question 18.

18. Given a 1.0 kg point mass thrown vertically in the air. It reaches a height h above the ground and falls back to its starting point. Neglect friction with the air. Of the five figures below, V vs T, the figure which best represents the velocity of the ball while in the air is figure ___.

A) A B) B C) C D) D E) E



19. Given a 2.0 kg mass at rest on a horizontal surface at point zero. For 30.0 m a constant horizontal force of 6.0 N is applied to the mass. For the first 15.0 m the surface is frictionless. For the second 15.0 m there is friction between the surface and the mass. The 6.0 N force continues but the mass slows to rest at the end of the 30.0 m. The coefficient of friction between the surface and the mass is ___ .

A) 0.6 B) 0.5 C) 0.3 D) 0.2 E) 0.1

20. Given a simple pendulum consisting of a 0.4 kg point mass attached at one end to a very light cord. The cord is 0.60 m long. The opposite end of the cord is attached to a rigid point so that the pendulum can swing. The cord is pulled taught and the mass is raised so that the cord is horizontal. Given a second simple pendulum of the same length suspended adjacent to the first and pulled aside just as the first. The mass of the second point mass pendulum is 0.2 kg. The masses are at rest. The masses are released at the same time. At the low point of the swing of the masses, the masses have a head-on collision. Just before they collide, the magnitude of the linear momentum of the 0.4 kg mass is ___ times the magnitude of the linear momentum of the 0.2 kg mass.

A) 4.0 B) 2.0 C) 1.4 D) 0.71 E) 0.5

21. Given a 4.0 N solid steel ball and a beaker containing water. All three are at rest setting on a balance. The balance reads 21.0 N. The steel ball is placed gently into the water, and rests on the bottom of the beaker, which is still on the balance. The water does not overflow the beaker. The balance now reads ___ N

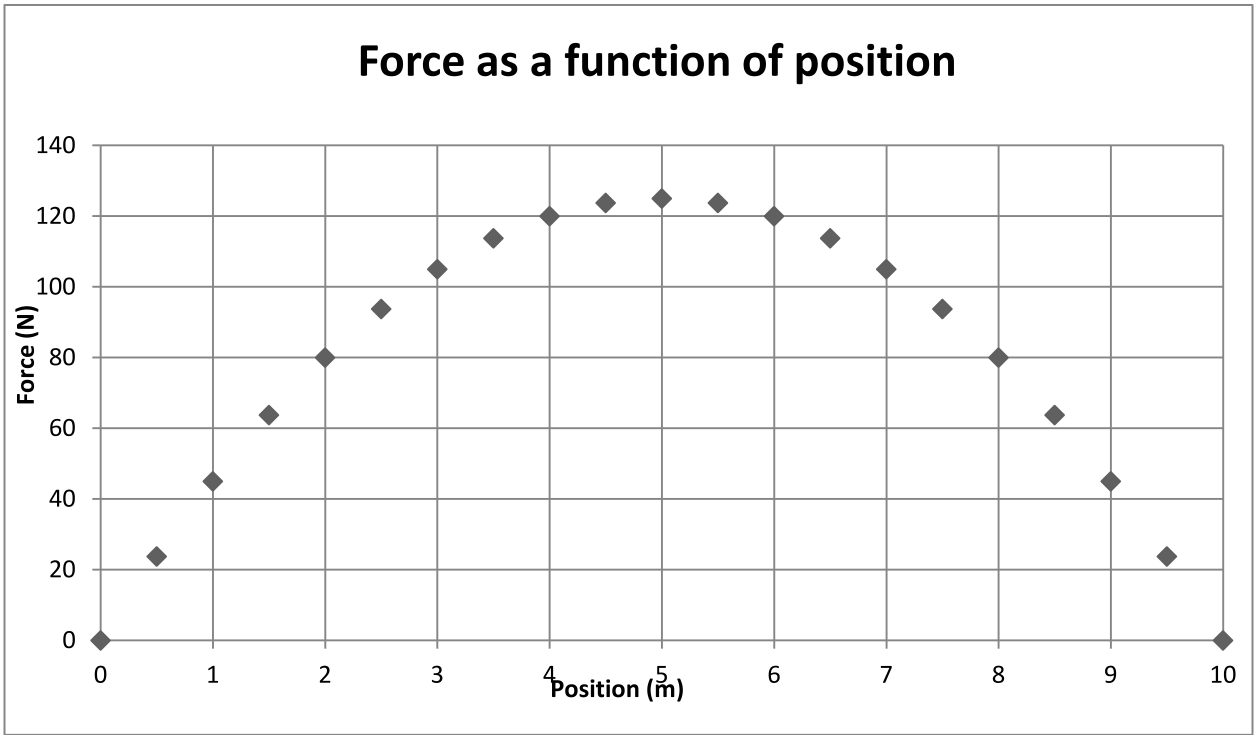
A) 17.0 B) 19.0 C) 21.0 D) 23.0 E) 25.0

22. Given two masses in rectilinear motion on a horizontal, frictionless surface traveling toward each other. Object I has a mass of 4.0 kg and a speed to the right of 2.0 m/s. The second object, object II has a mass of 2.0 kg and is moving to the left at 3.0 m/s . The objects have a perfectly elastic collision. As a result of the collision, object I is traveling at __ m/s.

A) -1.6 B) -1.3 C) -1.0 D) 2.0 E) 3.0

The following graph and description are used for questions 23 through 25.

23- 25 Given a graph of Net Force in Newtons vs Position in meters for a 3.0 kg mass originally at rest at the zero position when time was zero. The mass has rectilinear motion. It travels a distance of 10.0 m . The net force is in the same direction as the motion and varies between zero Newton and 125 Newtons.



23. If the mass had been 6.0 kg, the work done on the 6.0 kg mass would have been ___ times the work done on the 3.0 kg mass. (graph remains the same)

A) 2.0 B) 1.4 C) 1.0 D) 0.7 E) 0.5

24. The speed of the 3.0 kg mass when it reached the 10.0 meter mark was approximately ___ m/s . A) 33 B) 30 C) 27 D) 24 E) 21

25. The maximum acceleration of the 3.0 kg mass was approximately __ m/s^2 .

A) 125 B) 90 C) 42 D) 21 E) 14

Answer Key

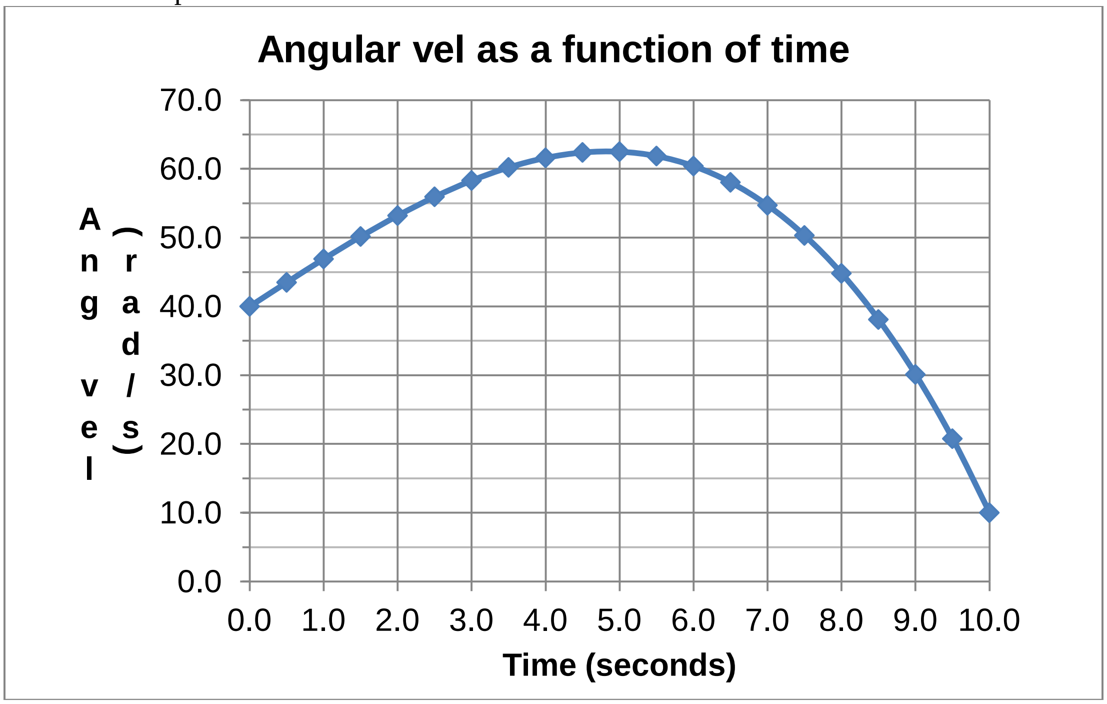
1. **C**	14. **B**
2. **E**	15. **D**
3. **B**	16. **B**
4. **A**	17. **E**
5. **A**	18. **E**
6. **E**	19. **C**
7. **C**	20. **B**
8. **D**	21. **C**
9. **B**	22. **B**
10. **E**	23. **C**
11. **C**	24. **D**
12. **C**	25. **C**
13. **D**	

SECOND YEAR PHYSICS TEST - FEBRUARY 2013

DIRECTIONS: For each statement or question, completely fill in the appropriate space on the answer sheet. Use the letter preceding the word or phrase or sketch which best completes the statement or answers the question. Each question is worth 4 points. Use **$9.8\ m/s^2$** as the acceleration due to gravity and 15 psi as 1 Atm. Unless otherwise stated assume ideal conditions including no friction with the air.

The following graph and description is used for items 1 through 4.

1-4. Given a record of a "point mass" of 8.0 kg traveling in a circle with a constant radius of 1.5 meters. The data were presented as shown.



1.When the angular velocity was 56.0 rad/s, the tangential velocity was approximately ___ m/s.
A) 168 B) 84 C) 37 D) 22 E) 15

2. During the first five seconds the mass traveled through an angle of approximately ___ radians.
A) 60 B) 70 C) 160 D) 270 E) 400

3. At the end of the time interval 0 to 10 seconds, the kinetic energy of the 8.0 kg mass was approximately ___ J .
A) 400 B) 900 C) 1,300 D) 1,800 E) 2,200

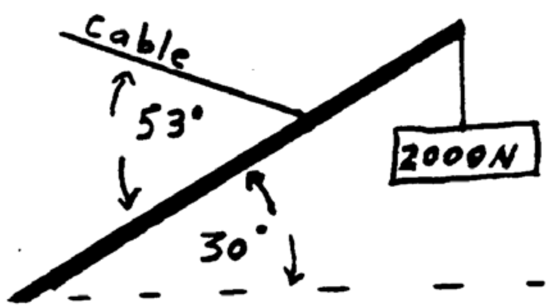
4. When the object's tangential velocity was 20.0 m/s, its angular momentum was approximately ___ kg-m^2/s. A) 360 B) 240 C) 120 D) 80 E) 60

5. Given water (density 1,000 kg/m^3) flowing at 12.0 m/s through a pipe with radius 0.02 m radius. The pipe extends upward 3.0 m to the second floor of a building, The water pressure remains unchanged. The radius of the pipe on the second floor is ___ m .
A) 0.122 B) 0.052 C) 0.043 D) 0.031 E) 0.023

6. Heat transfer by conduction through a portion of a wall is 20 J/s . The temperature on one side of the wall is 0 degrees Celsius and 20 degrees Celsius on the other. If the temperatures had been 0 degrees Celsius and 30 degrees Celsius, the heat transfer would have been ___ J/s .
A) 21.1 B) 22.2 C) 25 D) 26.2 E) 30

7. The specific heat of water is 4186 J/(kg C degree). To raise the temperature of 1.0 kg of water from 20 degrees Celsius to 40 degrees Celsius requires approximately___ J .
A) 84,000 B) 66,000 C) 33,000 D) 24,000 E) 4,000

The following figure and description are used for questions 8 and 9.



8-9 Given a uniform solid rod 6.0 m long. A very light cable ("massless") is attached to the rod at a point 4.0 m from its lower end. The rod weighs 2,000 N. A weight of 2,000 N hangs from the upper end of the rod. The lower end of the rod pivots in a support. The light cable makes an angle of about 53 degrees with the rod. (its sine is 0.8 ; cosine is 0.6). The rod is inclined so that it makes an angle of 30.0 degrees with the horizontal. Another weight of 2,000 N is attached to the rod at the point where the cord is attached to the rod.

8. The magnitude of the force in the cable is ___ N .
A) over 10,000 B) 9,400 C) between 7,500 and 6,500 D) 6,100 E) 5,800

9. If the 2,000 N weight at the upper end of the rod had been attached at the point where the cable is attached, not at the upper end where it was originally located, the magnitude of the force on the rod from the cable would be ___ its original value.
A) less than B) equal to C) more than

The following description is used for questions 10, 11, 12, and 13. (#13 top of next page)
10-13. Given a frictionless horizontal plane surface. Given a small 9.8 N mass attached to the left hand end of a horizontal "massless spring" . The right end of the spring is attached to a rigid vertical support. The spring rests on the horizontal frictionless surface. The force constant, k , of the spring is 39.2 N/m The mass and spring are initially in equilibrium and at rest. The mass is displaced from rest 0.2 m to the left of its equilibrium point and released with an initial speed of 2.0 m/s back toward the right, toward the rigid support. The mass oscillates in simple harmonic motion about its equilibrium point.

10. When the mass is 0.1 m from its equilibrium point, the acceleration of the mass is ___ m/s^2 .
A) 3.4 B) 3.9 C) 4.3 D) 4.7 E) 5.0

11. The amplitude for the simple harmonic motion is approximately ___ m .
A) 0.05 B) 0.1 C) 0.2 D) 0.3 E) 0.4

12. When the mass is 0.1 m from equilibrium, its speed was ___ m/s .
A) 0.8 B) 1.3 C) 1.8 D) 2.3 E) 2.8

13. If the spring constant had been 78.4 N/m , instead of 39.2 N/m , the frequency of the simple harmonic motion would have been ___ times its value when the spring constant was 39.2 N/m.
A) 2 B) 1.4 C) 1 D) 0.71 E) 0.5

The following description is used for questions 14 and 15

14-15. Given a spherical planet with constant density. Its mass is 4.0×10^{20} kg . Its radius is 4.0×10^{6} m . A small object weighs 200.0 N on the surface of the planet. It is in a space craft in a circular orbit about the planet. The radius of the object's orbit is 120,000 m above the surface of the planet.

14. The gravitational force on the object in orbit is approximately ___ times the 200.0 N gravitational force on the object when it was on the planet's surface.
A) zero (it is weightless) B) 0.2 C) 0.5 D) 0.7 E) almost one

15. The density of the planet is ___ kg/m^3
A) 1.5 B) 3.0 C) 4.5 D) 9.0 E) 135

The following description is used for questions 16, 17, and 18.
16-18. Given a flat square bottomed tank, like a box. It is constructed of thin sheets of plastic. The tank is 0.40 m wide and 0.20 m long. It is 0.15 m tall. A similar but smaller box is floating in the tank . The dimensions of the smaller box are half those of the tank, 0.20 m wide by 0.10 m long by 0.075 m tall. The smaller box is floating in fresh water in the tank with 0.025 m under the water and 0.050 m above the water level. With the smaller box floating in the larger tank, the water level in the larger is at the very top. The density of water is 1,000 kg/m^3 .

16. The pressure on the bottom of the tank created by the water and the smaller box is approximately __ Pa
A) 2,500 B) 2,200 C) 1,500 D) 1,200 E) 1,000

17. If the smaller box is removed from the larger tank, the water level in the tank would ___ .
A) rise (water would overflow)
B) drop 6.25×10^{-3} m
C) drop 12×10^{-3} m
D) drop 32×10^{-3} m
E) not change

18. If the smaller box is returned, and the original conditions restored, except that the smaller box is filled with ice so that the smaller box has enough ice in it to float with the top at the water level (flush with the water level). Over time the ice melts. The smaller box __ .
A) floats with 0.025 m out of the water
B) floats with 0.050 m out of the water
C) floats with the top at the water level (zero out of the water)
D) sinks half way to the bottom and stops
E) sinks to the bottom of the larger

19. Given a 0.20 kg mass of a solid metal. The metal is heated and placed in water. that is in a container. The specific heat of the metal is 400 J/kg-Celsius degree. The container is equivalent to 0.06 kg of water. It contains 0.200 kg of water. Assume that no heat is lost to nor gained from the surroundings. The original temperature of the water and container was 18.0 degrees Celsius. The final temperature of the water, container, and metal was 35 degrees Celsius . The specific heat of water is 4,186 J/kg-Celsius degree. The original temperature of the metal was ___ degrees Celsius.
A) 299 B) 270 C) 235 D) 196 E) 175

20. Given a uniform ladder 6.0 m long with a weight of 40.0 N . The ladder is leaning against a “smooth wall” at an angle of 60.0 degrees (top of the ladder is 5.2 m above the floor) . The coefficient of static friction between the bottom of the ladder and the floor is 0.40 . The force of friction is approximately ___ N .

A) 16 B) 14 C) 12 D) 10 E) 8

21. Given an ideal liquid flowing through a horizontal pipe which changes in diameter. The liquid is flowing from left to right. Measurements are taken along the direction of flow. The sum of the pressure and the kinetic energy per unit volume ___ .

A) increases as the diameter increases.
B) decreases as the diameter increases
C) increases as the diameter decreases
D) decreases as the diameter decreases
E) remains constant as the diameter increases

22. The unit for the product of volume and pressure is ___ .

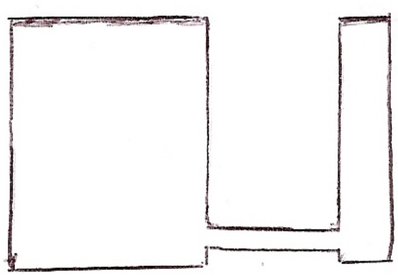
A) Watt B) Joule C) Newton D) Pascal E) meter/second^2

23. According to the ideal gas law, a given mass of a gas which occupies a volume of 2.0 liters at 127 degrees Celsius and a gauge pressure of 15 psi will occupy a volume of approximately ___ liter(s) at 273 degrees Celsius and a gauge pressure of 30 psi.

A) 2.2 B) 1.8 C) 1.4 D) 1.0 E) 0.6

The following figure and description is used for questions 24, and 25

24-25 The figure below represents a Pascal’s Principle device, a hydraulic lift. Given two 1.0 m tall circular cylinders. Their bottoms on a horizontal surface. The larger cylinder has a radius of 0.30 m . The smaller cylinder has a radius of 0.10 m . The two circular cylinders stand next to each other. They are joined by a narrow tube 0.01 m in diameter very near their bottoms. The tube and cylinders are filled with an ideal liquid. The cylinders each have essentially friction free “massless” pistons at their tops. The larger cylinder on the left has a weight of 100.0 N placed on the piston. A weight is placed on the smaller piston to put the system in equilibrium.



24. The pressure on the bottom of the larger cylinder is ___ times the pressure on the bottom of the smaller cylinder.

A) 9 B) 3 C) 1 D) 0.33 E) 0.11

25. If the original ideal liquid were replaced by a second ideal liquid with half the density of the original liquid, the weight on the smaller piston required to balance the 100.0 N on the larger piston, would have been ___ times the original weight..

A) 9 B) 3 C) 1 D) 0.33 E) 0.11

SECOND YEAR PHYSICS TEST – <u>Golden Rod test</u>

14 FEBRUARY, 2013

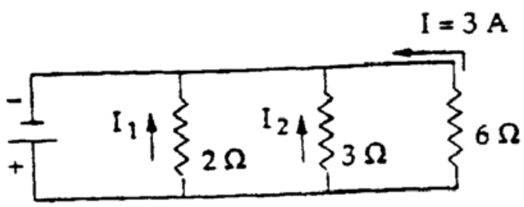
Answer Key

1.	B	14.	E
2.	D	15.	A
3.	B	16.	C
4.	B	17.	B
5.	E	18.	C
6.	E	19.	B
7.	A	20.	C
8.	C	21.	E
9.	A	22.	B
10.	B	23.	B
11.	E	24.	C
12.	D	25.	C
13.	B		

SECOND YEAR PHYSICS TEST - MARCH, 2013

DIRECTIONS: For each statement or question, completely fill in the appropriate space on the answer sheet. Use the letter preceding the word or phrase or sketch which best completes the statement or answers the question. Each question is worth 4 points. Use **$9.8\ m/s^2$** as the value of the acceleration due to gravity. Unless otherwise stated assume ideal conditions including no friction with the air. Sketches are not to scale. All motion is to be treated as non-relativistic. All current, unless otherwise described, is traditional current in the direction of the flow of positive charge. Charge on the electron = 1.6×10^{-19} Coul. Proton mass = 1.67×10^{-27} kg Electron mass = 9.1×10^{-31} kg
k = $9\text{x}10^{+9}$ Newton-meter^{+2}/ Coul^{+2} Wires and switches have no resistance.

The following description and figure are to be used for ques. 1 below.



1. Given three resistors, (2 ohms, 3 ohms, and 6 ohms, as shown) , arranged in parallel with an ideal emf. The directions of the currents in the resistors are shown. The current is 3 amperes in the 6 ohm resistor. The potential difference provided by the emf is ___ V .
A) 11 B) 18 C) 26 D) 36 E) 54

2. Given a battery connected to a 1,000 ohm resistor. The internal resistance of the battery is 10.0 ohms. The potential difference across the resistance is 9.00 volts. The resistor is disconnected and the potential difference across the battery is now approximately ___ volts.
A) 9.9 B) 9.7 C) 9.5 D) 9.3 E) 9.1

3. Two small masses held close to each other are released. They are no longer constrained to be at rest. They move . The electric force on each mass increases. Therefore, the charges on them __
A) must both be positive
B) must both be negative
C) must both have the same sign, either both positive or both negative
D) must have opposite signs
E) could have opposite signs or only one is charged

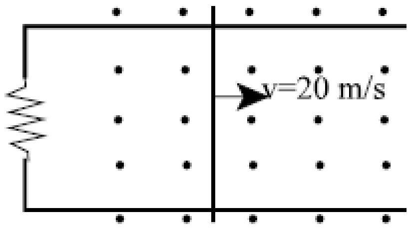
The following description is to be used for questions 4, and 5
4, 5 Given three thin walled hollow metal spheres. Sphere one, S1, has a radius of 0.12 m. Sphere two, S2, has a radius of 0.08 m . Sphere three, S3, has a radius of 0.04 m . The spheres are not touching each other and are uncharged. A charge Q is placed on sphere one giving it a potential difference V. Sphere one touches sphere two. They are separated and sphere two touches sphere three. The spheres are separated.

4. At a point 0.02 m from the center of sphere three, the potential difference is ___ Volts .
A) zero B) 2V/5 C) V/2 D) V E) 2V

5. Determine the magnitude of the electric field strength 0.07 m from the center of each sphere. Rank order in descending order these magnitudes of the electric field strength, E1, E2, E3,of spheres S1, S2, S3, respectively, placing the largest first. Indicate a tie with an equals sign (=)

A) E1, E2, E3 B) E1 = E2 = E3
C) E1, E2 = E3 D) E3, E1 = E2 E) E3, E2, E1

The following description and figure are to be used for ques. 6, and 7



6 and 7 Given a wire sliding to the right at a constant speed of 20 m/s . The wire lays across a pair of horizontal frictionless wires serving as "tracks" which are separated by 0.20 m. The wire is moving perpendicular to a constant vertical magnetic field of 2.5 Tesla pointing upward perpendicular to the page. **All** of the apparatus is in the magnetic field. The resistor in the circuit to the left is 10.0 ohms

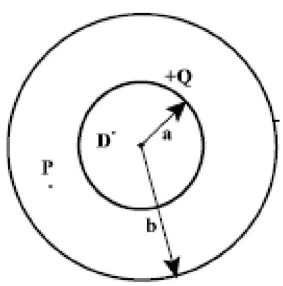
6. The power dissipated by the 10.0 ohm resistor is ___ W .
   A) 22 B) 10 C) 6 D) 2 E) 0.5

7. If the wire were at rest, leaving a closed loop. The current in the loop is zero. The magnetic field is still constant at 2.5 Tesla, and the entire apparatus is in the magnetic field. If the magnetic field decreases at a constant rate of 0.1 Tesla/second. Looking downward on the figure, the induced current would be ___
   A) zero B) counterclockwise C) clockwise

8. Given an ideal transformer. The number of turns of wire on the input side is 600. The number on the output side is 30. The output side is connected to a 40.0 ohm resistor. At time equals zero, a battery of 20 V is attached to the input side. After ten minutes the current on the output side is ___ A.
   A) zero B) 1 C) 2.5 D) 200.0 E) 400.0

The following description and figure are to be used for ques. 9 and 10

9, 10 Given a hollow metal sphere of radius **a** concentric with another hollow metal sphere of radius **b**, where radius **b** is larger than radius **a** . The inner sphere has a charge +Q



9. The magnitude of the electric field E, at a point D inside the inner sphere at a distance equal to a/2 from the center is ___ .

A) zero B) kQ/a^2 C) 1.5 kQ/a^2

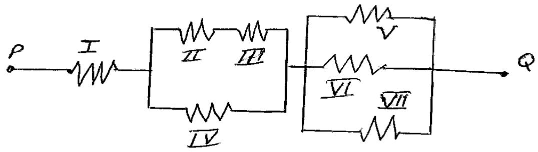
D) kQ/a^3 E) $kQ/(b^2 - a^2)$

10. The surface charge density on the inner sphere is __

A) zero B) Q/(4 x 3.14 x a) C) $Q/(4 \times 3.14 \times a^2)$

D) $2Q/(4 \times 3.14 \times (b^2 - a^2))$ E) $2Q/(4 \times 3.14 \times (b^2 - a^2))$

The figure and description below are for questions 11, 12 and 13



11, 12, 13 Given 7 identical resistors arranged as shown at left. Each is a 10.0 ohm resistor. An ideal emf of 70.0 volts is attached across P and Q, the ends

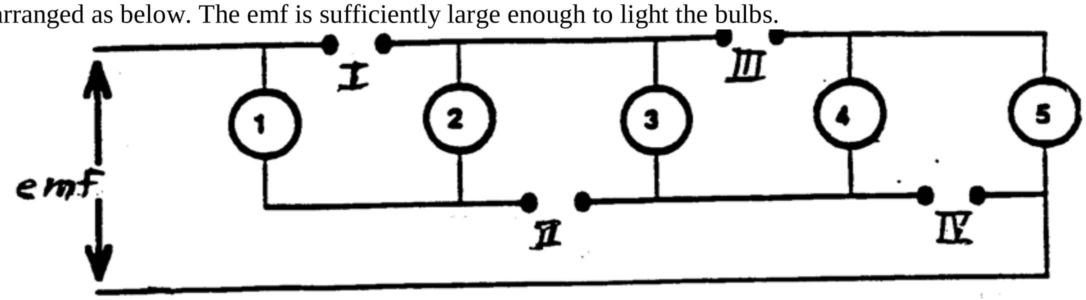
11. The emf's current is __ A .

A) 1/70 B) 3/70 C) 1.0
D) 3.5 E) 4.5

12. Of the potential differences across the resistors, the largest is the potential difference across resistor ___ .
   A) VII B) IV C) III D) I E) same value across all seven

13. If the power consumed by resistor I is P, then the power consumed by resistor V would be ___ P .
A) 0.67 B) 0.11 C) 1 D) 3 E) 4.6

The figure and description below are for questions 14 and 15.
14, 15. Given five identical bulbs (1, 2, 3, 4, 5), four switches (I, II, III, IV, all originally open), and an emf, arranged as below. The emf is sufficiently large enough to light the bulbs.

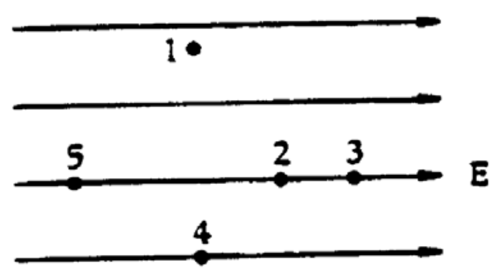


14. If switch II were closed, which bulbs will light?
A) only 1, 4, and 5 B) only 1, 3, and 4, C) only 1, 2, and 3 D) only 1, 3, and 5 E) all five light

15. If switches I and III are closed, which bulb(s) would glow the brightest?
A) 1,2,3,4 B) 5 C) 3,4,5 D) 1,3,5 E) all will glow the same

16. Magnetic field lines ____ .
A) cannot cross electric field lines
B) indicate the direction of magnetic force on a positive charge
C) cannot be used to show relative magnetic field strength
D) form closed loops
E) are always drawn in red

The figure and description are to be used for question 17



17. Given a uniform electric field pointing from left to right, as shown in the figure. Distances between points are to scale. Rank order on the basis of the magnitude of the potential difference between points. For the choices given place the values in descending order, putting largest first and smallest last. Indicate a tie with an equals.

A) The potential diff. between all points shown is equal but non-zero

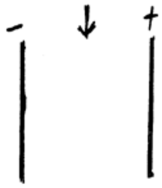
B) The potential diff. between all points shown is zero

C) (5 – 3) = (5 – 2) = (2 – 3), (1 – 4), (5 – 1) = (5 – 4)

D) (5 – 1) = (5 – 4), (1 – 4), (3 – 2), (5 – 2)

E) (5 – 3), (5 – 2), (5 – 1) = (5 – 4) , (2 – 3) , (1 – 4)

The following figure and description are used for ques.18, 19, 20, and 21



18-21 Given a thin walled parallel plate capacitor with vacuum between the plates. The capacitor is oriented vertically. Its plates are square, 0.06 m on a side. The capacitor is charged. Then the charging source is removed. The electric field in the space between the plates is uniform. There is an excess of plus charge, + Q , on the plate to the right, an excess of negative charge on the left. The plates are 0.08 m apart. The field between the plates is 2,500 Newtons per Coulomb (2,500 N/Coul). An electron moves at 2,000,000 m/s ($2X10^6$ m/s) vertically downward at the middle of the gap between the plates, as shown.

18. The electron strikes the right plate at a point approximately __ m from the top.
A) impossible, the electron travels through the field B) 0.01 C) 0.03 D) 0.05 E) 0.07

19. The potential difference across the plates is approximately _____ V .
A) 750 B) 500 C) 250 D) 200 E) 100

20. If an electron were held at rest at the left plate and released so that it moves straight across to the right plate, it would collide with the right plate at __ m/s .
A) 0.8×10^7 B) $5\text{x} 10^5$ C) $4\text{x} 10^4$ D) 10^3 E) 10^2

21. The magnitude of the minimum magnetic field, B, that would have been needed so that the electron traveled at 2,000,000 m/s through the fields undeflected would have been approximately __ T
A) 10^{-5} B) 10^{-3} C) 0.1 D) 10^{+3} E) 10^{+5}

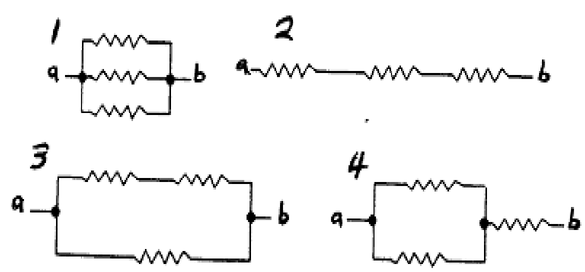
22. Given three charged particles (I an alpha particle, II a proton, and III an electron). The alpha particle has two positive charges and a mass about 4 times that of the proton. All three are projected at the same velocity into a uniform magnetic field. They are perpendicular to the magnetic field. All three move in circular paths. Rank order the particles in descending order on the basis of the magnitude of the radius of the circle they travel. List first the largest radius. If a tie, use an equals sign.
A) I, II, III B) III, II, I C) I = II, III D) III, II = I E) I, III, II

23..Given a charged particle moving in a circular path in a plane perpendicular to a uniform magnetic field. Of the following four quantities, which remain constant as the particle goes around in circular motion.
I radius of its circle II momentum III energy IV time for a revolution
A) All B) only I, II, and III C) only I, II, and IV
D) only I, III, and IV E) none

24. A proton and an electron are accelerated from rest and each reaches a velocity of 100,000 m/s.
A) The proton gains more energy than the electron and in less time
B) The electron gains more energy than the proton and in less time
C) The proton and the electron gain the same amount of energy and have the same speed.
D) The proton and the electron gain the same speed but the electron requires less time.
E) The proton and the electron gain the same speed and in the same time.

The figure and description below are to be used for question 25

25. Given three identical resistors of 4.0 ohms each arranged in different circuits as shown. Rank order the equivalent resistance across a-b for each combination. For the choices given place the values in descending order, putting largest equivalent resistance first and smallest last. Indicate a tie with an equals



A) 1 = 2, 3 = 4 B) 2, 4, 3, 1 C) 2, 3 = 4, 1

D) 4, 1, 3, 2 E) 3 = 4, 2, 1

SECOND YEAR PHYSICS TEST – MARCH 2013

Answer Key: **Golden Rod test**

1.	B	14.	A
2.	E	15.	**B**
3.	E	16.	D
4.	B	17.	**E**
5.	D	18.	**C**
6.	B	19.	D
7.	**B**	20.	A
8.	A	21.	B
9.	A	22.	A
10.	C	23.	D
11.	D	24.	**D**
12.	D	25.	B
13.	B		

SECOND - YEAR PHYSICS EXAM APRIL 2013

DIRECTIONS: Please print your name, date of the exam and school onto the scantron. Please check to see that your copy of this exam has 25 questions. For each statement or question, completely fill in the appropriate space on the answer card. Use the letter preceding the word, phrase, or figure which best completes the statement or answers the question. Each question is worth 4 points. **Use 3.00×10^8 m/s as the speed of light in a vacuum, $9.8\ m/s^2$ as the acceleration of gravity, and 3.1416 for PI or π**

1. The image formed by a single concave mirror can never be _____ .

A) real and reduced
B) real and enlarged
C) real and same size as object
D) virtual and reduced
E) virtual and enlarged

2. Two mechanical waves meeting at a point ___ .

A) combine at the point but bounce off each other like billiard balls
B) always invert each other
C) always reduce the size of each other
D) combine at the point but pass on by unchanged
E) combine at the point but pass on by distorted

3. Given a lens and a spherical mirror, both of positive focal length. The lens and mirror are placed in water and their focal lengths measured. Then the focal lengths are measured with both in air. The focal length of the lens in water is ___ its focal length in air, and the focal length of the mirror in water is ___ its focal length in air.

A) larger than, larger than
B) larger than, the same as
C) the same as, the same as
D) smaller than, smaller than
E) smaller than, the same as

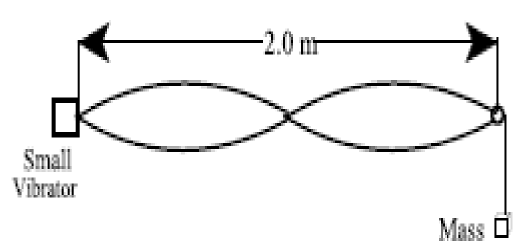
4. The Doppler Effect is characteristic of ___ .

A) water waves, sound waves, and light waves
B) only water waves
C) only sound waves
D) only light waves
E) only water and sound waves

5. When viewed from earth, the stars appear to “twinkle” . When the stars are viewed from the moon, the stars ___ .

A) appear to twinkle more
B) appear to twinkle the same as from earth
C) appear to twinkle less than on earth but almost as much
D) don’t twinkle

The following figure and description are for questions 6, 7, and 8. Given a very light taut string stretched horizontally. The left end is attached to a small vibrator. The right end has a mass and hanger attached, producing a tension in the string. The frequency of the vibrator is 100.0 Hz. Two meters of the string are in vibration. The string’s linear density is 1.40×10^{-4} kg/m. The speed of sound in the room is 340 m/s . There is a standing wave with two loops on the string. Consider the string’s ends as nodes.



6. The wavelength of the wave on the string is approximately ____ the wavelength of the note which it produces in the air.

A) one-third B) two-thirds C) the same as D) 1.7 times E) three times

7. The speed of the wave on the string is ___ m/s .

A) 340 B) 299 C) 200 D) 173 E) 144

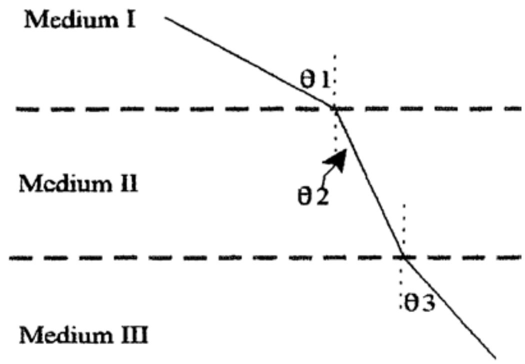
8. The tension in the string is changed. It is now four times the original tension. The frequency of the vibrator and the linear density of the string remain the same. . The new standing wave on the string would have __ loop(s) .

A) one B) two C) four D) eight E) none is formed

The following figure and description is for question 9

9. Given three homogeneous media with plane horizontal interfaces. A beam of monochromatic light passes from medium I through medium II and then through medium III, as shown in the figure. The speeds of the beam in successive media are V1,V2, and V3 respectively. The speed of the ray in medium I is ___ its speed in medium III

A) less than B) equal to C) more than
D) not enough data to tell



The following description is for questions 10, 11, and 12.
Given 2.0 m vertical glass tube sealed at its lower end, open at its upper end and filled completely with water. The diameter of the tube is approximately 0.04 m . The water level can be lowered. A tuning fork is struck over the open end, and the water level is lowered from the top. The first sound resonance for the sound from the tuning fork occurs when the water level has dropped to 0.16 m from the top. The second occurs when the level has dropped to 0.54 m, and the third at 0.92 m .

10. If the next resonance point were reached, the water level would be at the __ m mark.
A) 1.00 B) 1.08 C) 1.11 D) 1.30 E) 1.62

11. The wavelength in the air in the tube of the note from the tuning fork is __ m .
A) cannot be determined without knowing the frequency of the fork
B) 0.32 C) 0.38 D) 0.64 E) 0.76

12. If the temperature of the air in the tube were lower (be cooler), then the resonance points would appear ___ the open end of the tube.
A) closer to B) be the same distance from C) further from

13. The image formed on the retina of the eye is always ___
A) 0.001 the size of the object
B) farther from the eye's lens than the object
C) erect
D) real
E) larger than the object

The following figure and description are used for questions 14, and 15.
Given two thin lenses and a small object (a small arrow pointing upward). The small object is placed 0.30 m to the left of a thin positive lens of focal length 0.40 m . Another positive thin lens with a focal length of 0.45 m is placed 0.60 m to the right of the first positive lens. The lenses and the object are in air. The principal axes of the lenses coincide. The small object is also on that principal axis line.

14. The final image formed by this combination of lenses compared with the original small object is ____.
A) real and inverted
B) real and erect
C) virtual and inverted
D) virtual and erect
E) no image is formed

15. The magnitude of the distance of the final image from the 0.45 m focal length lens is__ m .
A) none is formed B) 0.90 C) 0.60 D) 0.45 E) 0.24

The following description is for questions 16, 17, and 18
Given a Young's double slit apparatus. The light used is monochromatic. The double slit is 3.0 m from the screen. An interference pattern is formed on the screen. It has maximums separated by 0.03 m . The center-to-center separation of the slits is 0.00003 m. Each slit is 0.00001 m wide.

16. The wavelength of the light is ___ x 10^{-7} m .
A) 50 B) 5 C) 4 D) 3 E) 2

17. If the width of a slit were doubled, the separation of the interference maximums on the screen would be ___ times the original separation.
A) 4 B) 2 C) 1 D) 0.5 E) 0.25

18. Using only one slit, the other slit being covered, the width of the central maximum formed by the single slit would be approximately ___ the separation of the adjacent maximums in the double slit pattern.
A) 1/3 B) 2/3 C) the same as D) 3 times E) 6 times

The following description is for questions 19 and 20
19, 20. Given a transmission diffraction grating in an optical spectrometer that is set for Fraunhofer conditions. The grating produces a second order maximum at 30.0 degrees (to the left and to the right of the forward direction) for a wavelength of 6.0 X 10^{-7} m.

19. The grating spacing (slit width) is approximately ___X 10^{-7} m
A) 36 B) 24 C) 16 D) 8.0 E) 0.8

20. If the area of the grating were doubled by adding more lines, but using the same slit width and the same separation between lines, the second order maximum would occur ___ .
A) at 60 degrees
B) at approximately 45 degrees
C) at 30 degrees
D) at approximately 15 degrees
E) at 7.5 degrees

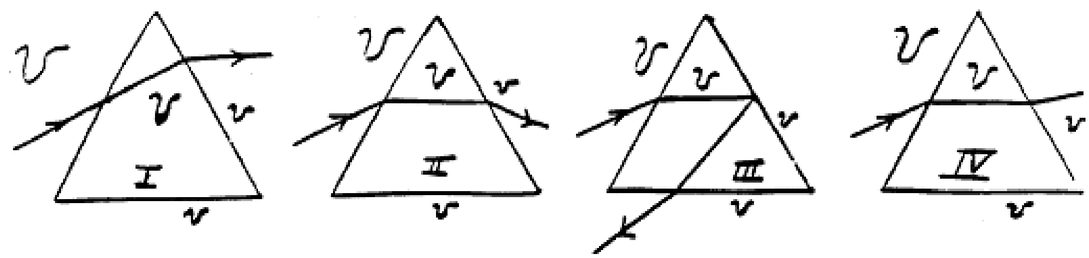
The following description is for questions 21 and 22.
Given an isotropic "point" sound source radiating a single frequency in all directions. At 4.0 m from the source, the intensity of the source is 0.08 W/m^{+2}.

21. The source's power is approximately __ W .
A) 16 B) 12 C) 8 D) 6 E) 4

22. The intensity of the source at 8.0 m from the source is ___ W/m^{+2}
A) 0.01 B) 0.02 C) 0.04 D) 0.06 E) 0.07

The following description and figure are for question 23.
23. Given a prism and a beam of light. The speed of the beam in the medium to the left of the prism is larger than the speed in the prism. The speed of the ray in the medium to the right of the prism, and the speed in the medium below are equal. It is less than in the prism. Four possible paths are indicated below, I, II, III, and IV. The path the ray could have taken is (are) path (s) __

A) only I B) only II C) only III D) only IV E) only II and III



I II III IV

24. Given two tuning forks which when sounded produced about the same volume. The frequencies of the forks are 244 Hz and 252 Hz. When sounded together they produce a note of 248 Hz which has ___ beats.

A) 2 B) 8 C) 12 D) 16 E) 20

25. Given an isotropic sound source which emits a short burst of sound. The sound travels to the left a distance of 75.0 meters and reflects off a flat wall. An observer who is 75.0 m to the right of the source receives the reflection and the sound from the source. The two sounds the observer receives have a time separation of 0.431 second. If at 20 degrees Celsius the speed of sound is 343 m/s, and increases by 0.6 m/s for each Celsius degree above 20 degrees, the temperature of the air is approximately ___ Celsius degrees.

A) 22 B) 24 C) 26 D) 28 E) 30

SECOND YEAR PHYSICS TEST – APRIL 2013

Answer Key: **<u>Golden Rod test</u>**

1.	**D**	14.	**A**
2.	**D**	15.	**C**
3.	**B**	16.	**D**
4.	**A**	17.	**C**
5.	**D**	18.	**E**
6.	**B**	19.	**B**
7.	**C**	20.	**C**
8.	**A**	21.	**A**
9.	**C**	22.	**B**
10.	**D**	23.	**D**
11.	**E**	24.	**B**
12.	**A**	25.	**D**
13.	**D**		