Preview Assessment q01

Name: q01

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **10 points** Save

The e is a unit of charge. It is not an SI unit of charge but it is a valid unit of charge. In terms of this unit of charge, what is the charge of each of the particles listed below?

- \- proton
- \- electron
- \- helium nucleus
- \- hydrogen atom

A. -2 e
B. -1 e
C. 0 e
D. +1 e
E. +2 e

Question 2 **8 points** Save

A neutral Ping Pong ball hangs from the ceiling by a thread. A person rubs a rubber rod with animal fur and then touches the Ping Pong ball with the rubber rod. After that, what is the charge of the Ping Pong ball?

- Positive.
- Negative
- Neutral

Question 3 **7 points** Save

A neutral, hollow, metal ball is on the end of a glass rod so that one can move it around easily without touching the ball. A rubber rod is rubbed with rabbit fur. The rubber rod is brought very near the metal ball but not allowed to touch the metal ball. In this arrangement the pair is brought near a metal faucet and the ball is touched momentarily to the faucet. (The faucet is attached to a copper pipe which extends deep into the earth.) The rod and ball are moved away from the faucet and then they are moved farther away from each other. At this point, what kind of charge, if any, does the ball have?

- Positive.
- Negative.
- None.

Question 4 **7 points** Save

Consider two identical plastic foam balls each having a thin sheath of aluminum foil. One of the balls has some positive charge and the other has the same amount of negative charge. All of the charge resides on the aluminum foil. Each ball is on the end of its own thin glass rod which serves as a handle. A person brings one of the balls in contact with the other and then separates them. What is the sign of the charge on the ball that was originally charged positively.

- Positive.

- Negative.
- It has no charge.

Question 5 **7 points** Save

Consider two small metal balls, one having a charge of +1 microcoulombs and the other having a charge of +3 microcoulombs. The balls are brought into momentary contact with each other (assume each ball is on the end of its own non-conducting rod for handling purposes) and then separated. What is the charge on each ball then?

- They are both neutral.
- The charge on each ball is the same as it was prior to the balls making contact with each other.
- Each ball has +2 microcoulombs of charge.
- The ball that originally had +1 microcoulomb of charge is neutral and the other has +4 microcoulombs of charge.

Question 6 **8 points** Save

Consider two Styrofoam cups. Each is on the end of its own neutral slender glass rod which serves as a handle. One of the cups has a fixed amount of positive charge uniformly distributed over the entire surface of the cup. The other cup has the same amount of negative charge uniformly distributed over its entire surface. A person taps one of the cups with the other cup. After the tap, what is the sign of the charge of the cup that was originally positively charged?

- Positive.
- Negative.
- It has no charge.

Question 7 **7 points** Save

If you rub a rubber rod with rabbit fur (thus giving the rod a negative charge) and bring the rod near some bits of neutral paper, the rod will attract the bits of paper. Though they remain neutral, the bits of paper do become polarized--the end of a bit of paper closer to the rod becomes positive while the end farther from the rod becomes negative. Given that the amount of negative charge on one end of the bit of paper is equal to the amount of positive on the other end, it might seem that the negatively charged rubber rod would repel the negative end of the bit of paper with just as much force as that with which it attracts the positive end. Why then, is there a net attractive force on the bit of paper?

- The far end of the bit of paper is shielded from the rod by the rest of the paper so the rubber rod does not repel it.
- There is actually less negative charge on the bit of paper then there is positive charge so there is a net positive charge on the bit of paper, thus, the negatively charged rod exerts a net attractive force on the bit of paper.
- There is no force exerted on the bit of paper.
- The end of the bit of paper that has positive charge is closer to the rubber rod then the end with the negative charge. The Coulomb force depends on the separation of the rubber rod and the other charge. The smaller the separation, the greater the force. Hence the rubber rod exerts a greater attractive force on the positive end of the bit of paper than it does a repulsive force on the negatively charged end. The result is a net attractive force.

Question 8 **6 points** Save

Consider an electron and a proton, at an instant in time, to be at a separation of 5 cm from each other. Assume the pair to be totally isolated from its surroundings in the vacuum of outer space.

-	Upon which particle, if either, is the greater force being exerted?	A. The electron.
-	Which particle, if either, is experiencing the greater acceleration?	B. The proton.
		C. Neither.

- Which particle, if either, has the greater velocity?

D. Not enough information is given to answer this question.

Question 9 **8 points** Save

Consider two charged particles at a separation of 4 cm. Particle #1 has a charge of +2 microcoulombs. Particle #2 has a charge of +16 microcoulombs. How does the magnitude of the force exerted on particle #1 by particle #2 compare with the magnitude of the force exerted on particle #2 by particle #1?

- ◯ The two forces are identical in magnitude.
- ◯ The magnitude of the force exerted on particle #1 by particle #2 is greater than the magnitude of the force exerted on particle #2 by particle #1.
- ◯ The magnitude of the force exerted on particle #2 by particle #1 is greater than the magnitude of the force exerted on particle #1 by particle #2.

Question 10 **8 points** Save

Consider two charged particles. At a given separation each particle exerts a force of .12 N on the other. What force does each exert on the other after someone moves the particles closer together so that their distance is half the original distance?

- ◯ .03 N
- ◯ .06 N
- ◯ .12 N
- ◯ .24 N
- ◯ .48 N

Question 11 **8 points** Save

Consider two charged particles. At a given separation each particle exerts a force of .12 N on the other. What force does each exert on the other after someone moves the particles farther apart so that their separation is twice the original distance?

- ◯ .03 N
- ◯ .06 N
- ◯ .12 N
- ◯ .24 N
- ◯ .48 N

Question 12 **8 points** Save

Consider two positively charged particles at a separation of 2.0 cm. One of the charged particles is moving toward the other charged particle with a speed of 15 m/s. No forces except for the Coulomb force of repulsion (also known as the electrostatic force of repulsion) act on either particle. Is this situation, the one just described, actually possible?

- ◯ Yes.
- ◯ No.

Question 13 **8 points** Save

Consider two identical small metal balls, one having a charge of +1 microcoulombs and the other having a charge of +3 microcoulombs. The balls are separated from each other by 15 cm. Each exerts a force F on the other. The balls are brought into momentary contact with each other (assume each ball is on the end of its own non-conducting rod for handling purposes) and then separated such that the distance between them is once again 15 cm. At this point, each exerts a force F' on the other. How does F' compare with F?

- F' = F
- F' > F
- F' < F

Save Submit

Preview Assessment q02

Name: q02

Instructions:

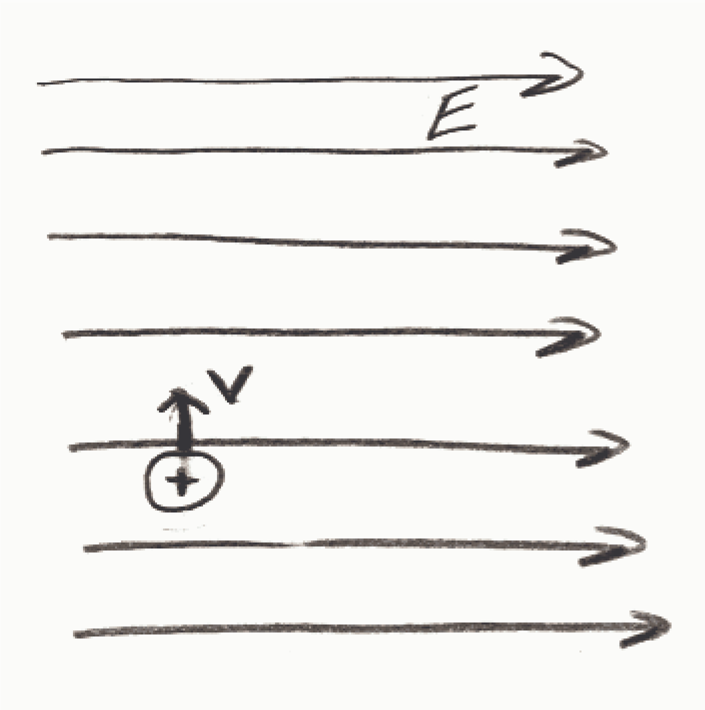
Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

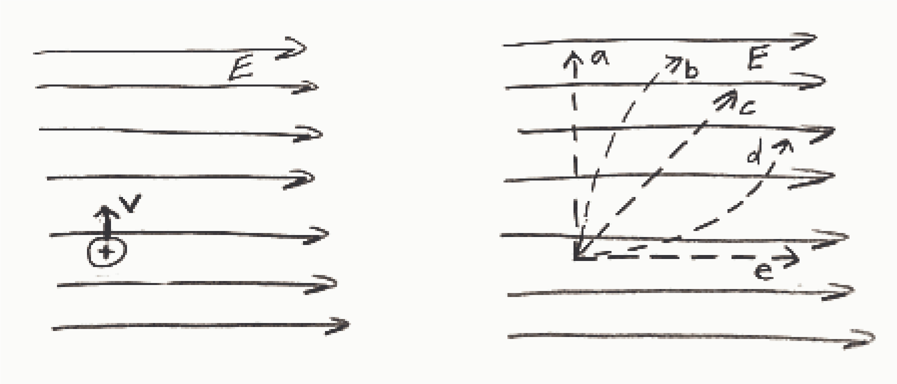
Depicted below is a positively charged particle in a rightward-directed electric field. The particle has a velocity directed toward the top of the screen. What is the direction of the force, if any, exerted on the charged particle by the electric field?



- Toward the top of the screen.
- Rightward.
- Toward the bottom of the screen.
- Leftward.
- Out of the screen. (Toward the viewer.)
- Into the screen. (Away from the viewer.)

Question 2 **20 points** Save

Depicted below is a positively charged particle in a uniform rightward-directed electric field. The particle has a velocity directed toward the top of the screen. Which of the paths depicted below right is the particle most likely to follow given that the force, if any, exerted on the particle by the electric field is the only force exerted on the particle.



- Path a
- Path b
- Path c
- Path d
- Path e

Question 3 **20 points** Save

Is it possible for an electron to be moving northward in a northward-directed electric field?

- Only if there is a northward force exerted on the particle by some agent other than the electric field.
- Yes, even if the force exerted on the electron by the electric field is the only force acting on the particle.
- No.

Question 4 **20 points** Save

Which of the following is not true of an electric field?

- It has direction.
- It cannot exist in vacuum.
- It exists in the region around a charged particle or distribution of charged particles.
- It is the association of a force-per-charge with points in space.
- It will exert a force on any charged particle that is in the electric field.
- It is invisible.

Question 5 **20 points** Save

Why is it nonsense to say that an electric field attracts a charged particle?

- Electric fields only repel charged particles. If the particle is positive the electric field repels it one way and if it is negative the electric field repels it the other way, but, the electric field always repels a charged particle.
- It is not nonsense. That is exactly what an electric field does to any negatively charged particle.
- It is not nonsense. That is exactly what an electric field does to any positively charged particle.
- The electric field exerts a force on a charged particle that is in the electric field. But the word "attract" cannot be used to characterize that force. For an electric field to attract a charged particle the electric field would have to pull the charged particle toward itself. But the particle is "in" the electric field so there is no such direction as "toward the electric field." It would be like saying that air attracts a helium-filled balloon that is in the air or that

seawater attracts a fish that is in the ocean.

Save Submit

Preview Assessment Lec 03 Quiz

Name: Lec 03 Quiz

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

In the expression ½kx^2 for the potential energy stored in the spring, what does the x represent?

- The length of the spring.
- The amount by which the spring is stretched or compressed.
- Both of the other answers are correct.

Question 2 **20 points** Save

Match the units to the physical quantity that is measured in those units.

- \- kg
- \- J
- \- m
- \- m/s
- \- s

A. time
B. velocity
C. energy
D. mass
E. distance

Question 3 **20 points** Save

A block of mass m, on a flat horizontal frictionless surface, is pushed up against the end of a horizontal spring, the other end of which is connected to a wall, so that it compresses the spring by an amount x. The force constant of the spring is k. Consider the mass of the spring to be negligible. The block is released, and the spring pushes the block away from the wall. What is the kinetic energy of the block after it loses contact with the spring? (Hint: From the wording of the question you are supposed to know that m, k, and x are to be considered known quantities, and, that your answer should have only known quantities in it.)

- 0 mgh
- ½mv^2
- ½kx^2
- kx^2
- ½kx^2-mgh
- No other answer provided is correct.

Question 4 **20 points** Save

Which has more rotational kinetic energy, an object with a rotational inertia of 4 kg·m^2 and an angular velocity of 8 rad/s, or, an object with a rotational inertia of 8 kg·m^2 and an angular velocity of 4 rad/s?

- An object with a rotational inertia of 4 kg·m^2 and an angular velocity of 8 rad/s.
- An object with a rotational inertia of 8 kg·m^2 and an angular velocity of 4 rad/s.
- Neither. They both have the same amount of kinetic energy.

Question 5 **20 points** Save

A disk lies horizontally on a massless, frictionless, rotational motion support such that the disk is spinning freely about a vertical axis through the center of the disk and perpendicular to the face of the disk. A second disk, identical to the first disk is held in place a negligible height (immeasurably close but not touching) above the first disk. The second disk is aligned so perfectly with the first disk that the axis of rotation of the first disk also passes through the center of the second disk. The person holding the second disk drops it onto the first disk and the two disks spin as one. Is mechanical energy conserved in this process?

- Yes
- No

Save Submit

Preview Assessment Lec 04 Quiz

Name: Lec 04 Quiz

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

Consider a bowling ball and a Ping Pong ball, each moving along a straight line path at constant velocity. Which has the greater magnitude of momentum?

- Neither, they both have the same momentum.
- The bowling ball has the greater momentum.
- The Ping Pong ball has the greater momentum.
- Insufficient information is given to determine a definite answer.

Question 2 **20 points** Save

Consider two cars, both moving eastward along a straight road. Car 1 is in front of car 2. Car 1 has a mass of 1200 kg and a speed of 24 m/s. Car 2 has a mass of 1100 kg and a speed of 32 m/s. Consider eastward to be the positive direction. Car 2 collides with car 1. The two cars stick together and move off as one object. No external eastward/westward forces act on either car. What is the total momentum of the combination object, consisting of the two cars stuck together, after the collision?

- Zero
- 6400 kg·m/s
- 28,800 kg·m/s
- 35,200 kg·m/s
- 64,000 kg·m/s
- 128,800 kg·m/s
- No other answer provided is correct.

Question 3 **20 points** Save

Consider two cars, both moving eastward along a straight road. Car 1 is in front of car 2. Car 1 has a mass of 1200 kg and a speed of 24 m/s. Car 2 has a mass of 1100 kg and a speed of 32 m/s. Consider eastward to be the positive direction. Car 2 collides with car 1. The two cars stick together and move off as one object. No external eastward/westward forces act on either car. What is the mass of the combination object consisting of the two cars stuck together?

- 100 kg
- 1100 kg
- 1200 kg
- No other answer provided is correct.

Question 4 **20 points** Save

Consider two cars, both moving eastward along a straight road. Car 1 is in front of car 2. Car 1 has a mass of 1200 kg and a speed of 24 m/s. Car 2 has a mass of 1100 kg and a speed of 32 m/s. Consider eastward to be the positive direction. Car 2 collides with car 1. The two cars stick together and move off as one object. No external eastward/westward forces act on either car. What is the total momentum of the system of cars prior to the collision?

- Zero
- 6400 kg·m/s
- 28,800 kg·m/s
- 35,200 kg·m/s
- 64,000 kg·m/s
- 128,800 kg·m/s
- No other answer provided is correct.

Question 5 **20 points** Save

Consider two cars, both moving eastward along a straight road. Car 1 is in front of car 2. Car 1 has a mass of 1200 kg and a speed of 24 m/s. Car 2 has a mass of 1100 kg and a speed of 32 m/s. Consider eastward to be the positive direction. Car 2 collides with car 1. The two cars stick together and move off as one object. No external eastward/westward forces act on either car. What is the velocity of the combination object, consisting of the two cars stuck together, after the collision?

- Zero
- 24 m/s
- 28 m/s
- 32 m/s
- 56 m/s
- 2300 m/s
- No other answer provided is correct.

Save Submit

Preview Assessment q05

Name: q05

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **30 points** Save

Which of the following is true of the electric potential? (Indicate all that apply.)

- [ ] It gives the force-per-charge that a charged particle would experience if it were located at a point in space where the electric potential exists.
- [ ] It gives the electric-potential-energy-per-charge-of-the-particle that a charged particle would have if it were located at a point in space where the electric potential exists.
- [ ] It is a scalar.
- [ ] It characterizes empty points in space in the region of a charged particle or distribution of charged particles.

Question 2 **15 points** Save

"A proton (a positively charged elementary particle) is released from rest at a point in space where the electric potential is 15 volts. Subsequent to its release the particle is subject to no force other that that due to the electric field characterized by the electric potential. Later when the particle is at a point in space where the electric potential is 25 volts..."

Are the circumstances discussed in the above quote possible?

- ○ Yes.
- ○ No.

Question 3 **20 points** Save

Which one of the following is true of electric potential but is **not** true of an electric field?

- ○ It exists in the region of space around a charged particle or distribution of charged particles.
- ○ It is the association of a scalar with empty points in space.
- ○ It represents the force-per-charge that would be experienced by a charged particle in it.
- ○ It is caused to exist by a charged particle or distribution of charged particles.

Question 4 **20 points** Save

What is the difference between electric potential and electric potential energy? (Indicate all that apply.)

- [ ] As its name implies, electric potential energy is a form of energy. Electric potential, on the other hand, is a kind of force.
- [ ] As its name implies, electric potential energy is a form of energy. Electric potential, on the other hand, is a capacity to do work.
- [ ] Electric potential energy is the energy of position that a particle with a particular amount of charge has or would have (because of the fact that it is in an electric field) if it were at a particular point in space, whereas, electric potential characterizes a point in space which may be empty.

Electric potential energy is just that whereas electric potential is electric-potential-energy-per-charge.

Question 5 **15 points** Save

A source charge creates an electric field to exist in the region of space around that source charge. The electric field exerts a force on any test charge that finds itself in the region of space where the electric field exits. The source charge or distribution of source charge is the cause of the electric field. The test charge is the "victim" of the electric field.

In the case of the electric potential, when we write

$$U = qV$$

is the q the source charge or is it the test charge?

- The source charge.
- The test charge.

Save Submit

Preview Assessment q06

Name: q06

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **24 points** Save

Which of the following represent the two kinds of basic (single-concept) electric potential problems? (TWO ANSWERS)

- ☐ Given information on the electric field in a region of space, find the velocity of the charged particle that is producing that electric potential.
- ☐ Given a charged particle or distribution of charged particles, find the electric potential at a point or points in space in the vicinity of that charged particle or distribution of charged particles.
- ☐ Given the electric potential, find the electric potential energy of a charged particle that finds itself at a location in space where the electric potential is known.
- ☐ Given the velocity and acceleration of a charged particle, find the direction of the electric potential produced by the motion of that charged particle.

Question 2 **16 points** Save

A proton (mass = 1.67 x 10^{-26} kg, charge = 1.60 x 10^{-19} C) is moving at a speed of 8.50 x 10^4 m/s at a point in an evacuated region of space where the electric potential is 35.0 volts. No force but the force of the electric field characterized by the electric potential acts on the proton. The particle travels to a point in the evacuated region of space where the electric potential is 47.0 Volts. What is the speed of the particle at that point in space?

- ○ 0 m/s
- ○ 12.0 eV
- ○ 6.99 x 10^9 m/s
- ○ 8.36 x 10^4 m/s
- ○ The proton cannot move to a point in space where the electric potential is higher than it is at its initial location.

Question 3 **15 points** Save

An electron is released from rest at a point in an evacuated region of space at which the electric potential is 5.0 volts. No force other than the force of the electric field characterized by the electric potential under discussion acts on the electron. What is the kinetic energy of the electron when it is at a location where the electric potential is 16 volts?

- ○ 21 m/s
- ○ 21 eV
- ○ 21 J
- ○ 11 eV
- ○ 11 J
- ○ Under the given conditions, the electron would never go to a location where the electric potential is 16 volts.

Question 4 **15 points** Save

Given a set of equipotential surfaces how does one determine the corresponding set of electric field lines?

- The electric field lines are those lines which are everywhere perpendicular to the equipotential surfaces and are directed (as indicated in a diagram by means of arrowheads) from low potential toward high potential.
- The electric field lines are those lines which are everywhere perpendicular to the equipotential surfaces and are directed (as indicated in a diagram by means of arrowheads) from high potential toward low potential.
- Where the equipotential surfaces intersect an imaginary flat surface, lines are formed. Those lines are the electric field lines.
- None of the other answers are correct.

Question 5 **15 points** Save

Two identical particles, each having a charge of 1.0 coulombs, are separated by 2.0 meters. What is the electric potential, due to the pair of charged particles, at the point midway between the two particles.

- 0 volts
- 2.2×10^9 volts
- 4.5×10^9 volts
- 9.0×10^9 volts
- 18×10^9 volts
- None of the other answers is correct

Question 6 **15 points** Save

Where is the electric potential due to a single negatively charged particle a maximum?

- At any location that is an infinite distance from the charged particle.
- At the location of the charged particle.
- At those locations as close as possible to the particle. In the limit, as the separation between the charged particle and the empty point in space under consideration approaches zero, the electric potential owing to the charged particle approaches its maximum value.
- None of the other answers is correct.

Save Submit

Preview Assessment q07

Name: q07

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

The electric potential at a point in a uniform electric field in an evacuated region of space is 4.0 volts. The electric potential at a point 25 cm to the east of the first point is 8.0 volts. The separation of the points is the shortest distance between the equipotential surfaces on which each point lies. What is the magnitude and direction of the electric field in the evacuated region of space?

- .16 N/C eastward
- .16 N/C westward
- 4.0 N/C eastward
- 4.0 N/C westward
- 16 N/C eastward
- 16 N/C westward

Question 2 **20 points** Save

Two perfectly conducting spheres are in an evacuated region of space. One is at a potential of −12 volts and the other is at a potential of 15 volts. A free electron is released from rest at the surface of the sphere at −12 volts. With what speed does it crash into the other sphere? (The mass of an electron is 9.11×10^{-31} kg.)

- 0 m/s
- 4.3×10^{-18} m/s
- 3.1×10^{6} m/s
- 9.5×10^{12} m/s

Question 3 **20 points** Save

Two perfectly conducting spheres are in an evacuated region of space. One is at a potential of -1200 volts and the other is at a potential of 1500 volts. A free electron is released from rest at the surface of the sphere at -1200 volts. With what kinetic energy does it crash into the other sphere?

- There is no way it would ever crash into the other sphere. It is already at the lowest potential in the region.
- -2700 eV
- -1500 eV
- -1200 eV
- -300 eV
- 0 eV
- 300 eV

- 1200 eV
- 1500 eV
- 2700 eV

Question 4 **20 points** Save

Two perfectly conducting spheres are in an evacuated region of space. One is at a potential of -1200 volts and the other is at a potential of 1500 volts. A free electron is released from rest at the surface of the sphere at -1200 volts. With what kinetic energy does it crash into the other sphere?

- There is no way that the electron would ever crash into the other sphere.
- -5.6×10^{-16} J
- -4.3×10^{-16} J
- -2.4×10^{-16} J
- -4.8×10^{-17} J
- 0 J
- 4.8×10^{-17} J
- 2.4×10^{-16} J
- 4.3×10^{-16} J
- 5.6×10^{-16} J

Question 5 **20 points** Save

Which statement about the electric potential of a solid object made out of a perfectly conducting medium is most correct?

- The electric potential everywhere in and on the conductor must be zero.
- The electric potential inside the conductor must be zero but the electric potential of the surface can have any value.
- The electric potential at the various points in and on the conductor depends on the charge distribution. Any given point in or on the conductor can have any value and it is possible for different points to have different values of electric potential.
- The electric potential can have any value but all points in and on the conductor always have one and the same value of electric potential.

Save Submit

Preview Assessment q08

Name: q08

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

A capacitor can serve as which of the following? (Indicate all that apply.)

- [ ] A current measuring device.
- [ ] A voltmeter.
- [ ] A resistor.
- [ ] A charge storage device.
- [ ] An energy storage device.

Question 2 **20 points** Save

Consider a capacitor consisting of two flat metal plates of one and the same size. The plates are facing each other and, they are well-aligned with each other. The plates are separated by air. Which of the following statements is true?

- [ ] The greater the separation of the plates, the greater the capacitance of the capacitor.
- [ ] The smaller the separation of the plates, the greater the capacitance of the capacitor.
- [ ] The greater the area of the plates, the greater the capacitance of the capacitor.
- [ ] The smaller the area of the plates, the greater the capacitance of the capacitor.

Question 3 **20 points** Save

Suppose that you were given a capacitor having capacitance C and that for various voltage settings of a power supply, you measured the voltage across the capacitor and the charge on the capacitor. Assume that your results are ideal. If you made a graph of the charge on the capacitor vs. the voltage across the capacitor, on what kind of curve or line would your data points fall.

- ○ An increasing exponential curve.
- ○ A decreasing exponential curve.
- ○ A straight line of slope C passing through the origin.
- ○ A straight line of slope 1/C passing through the origin.
- ○ A straight line of slope C that does not pass through the origin.
- ○ A straight line of slope 1/C that does not pass through the origin.

Question 4 **20 points** Save

What do we mean when we say that a capacitor has an amount of charge Q on it?

- One of the plates of the capacitor holds a charge Q and the other holds a charge −Q.
- Both plates of the capacitor are, as always, neutral, and the insulating material between the plates holds a charge of Q.
- The sum of the charge on one plate of the capacitor and the charge on the other plate of the capacitor is Q.
- The sum of the charge on one plate of the capacitor, the charge on the other plate of the capacitor, and the charge of the dielectric medium in between the plates is Q.

Question 5 **20 points** Save

You are provided with two strips of metallic foil, two strips of waxed paper, and two metal paper clips. Each strip is in the shape of a rectangle, 2 inches wide and 5 feet long. Which of the following would result in the best capacitor?

- Layer the strips, alternating metal with paper. Roll up the stack into the shape of a 2-inch-long cylinder. Attach one paper clip to one of the pieces of waxed paper and the other to the other piece of waxed paper. The paper clips serve as the terminals of the capacitor.
- Layer the strips, alternating metal with paper. Roll up the stack into the shape of a 2-inch-long cylinder. Attach one paper clip to one of the pieces of foil and the other to the other piece of foil. The paper clips serve as the terminals of the capacitor.
- Discard one of the strips of waxed paper. Sandwich the other one in between the strips of foil. Roll up the stack into the shape of a 2-inch-long cylinder. Attach one paper clip to one of the pieces of foil and the other to the other piece of foil. The paper clips serve as the terminals of the capacitor.

Save Submit

Preview Assessment q09

Name: q09

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **24 points** Save

Match each item to its description.

- \- Seat of EMF
- \- Resistor
- \- Circuit
- \- Current
- \- Voltage
- \- Terminal

A. Charge flow rate.
B. One of the two metal ends of a circuit element (such as resistor or seat of EMF) to which one connects wires when one connects that circuit element in a circuit.
C. Electric potential difference—something that exists but does not go anywhere.
D. A two-terminal circuit element intentionally designed to be a poor conductor.
E. A device used to measure charge flow rate.
F. A two-terminal circuit element designed to maintain a constant potential difference between its terminals.
G. A closed conducting path.

Question 2 **16 points** Save

Consider a high school built to handle 1500 students but attended by 2500 students. Between classes, the halls are jam-packed with students moving to their next class. About an hour after school however, the halls are practically empty and the students from the track team zip through those halls at a fast pace. Which situation is a better analogy for the movement of charge through a circuit?

- The students moving through the crowded halls.
- The students on the track team running through nearly empty halls.

Question 3 **20 points** Save

Consider a positively charged particle in a circuit. As it moves through a resistor in the circuit, the positively charged particle moves from a point (one end of the resistor) in the circuit where the electric potential is high to a point (the other end of the resistor) where the electric potential is low. That means it moves from a point where it has high potential energy to a point where it has low potential energy. Conservation of energy would suggest that the decrease in the potential energy of the particle should be accompanied by an increase in kinetic energy. Why doesn't the particle speed up as it goes through the resistor?

- The particle does speed up. In fact, the charged particles in a circuit are continually speeding up the whole time the circuit is connected.
- There is indeed a tendency of the positively charged particle to speed up but it keeps bumping into lattice imperfections and impurities in the resistor, thus giving up some of its energy to the resistor. Such energy manifests itself as thermal energy of the resistor which is given off by the resistor as heat.
- The electric potential does not exert a force on the charged particle. Without a force there is no acceleration, and, without acceleration there is no change in velocity.

- The particle does speed up as it goes through the resistor but it reverts to its original speed as soon as it hits the wire on the other end.

Question 4 **20 points** Save

In that part of a circuit, outside of any batteries or power supplies, what is it that actually pushes charged particles through the circuit?

- The resistance of the resistors.
- The voltage.
- An electric field.
- The current.

Question 5 **20 points** Save

What is electric current? (Choose the one BEST answer.)

- Electric potential difference.
- Flow of voltage.
- Charge flow rate.
- Voltage divided by resistance.

Save Submit

Preview Assessment q10

Name: q10

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **15 points** Save

What all can the power P possibly represent in the expression $P = IV$ where I is current and V is voltage?

- The rate at which energy is delivered to a resistor by the rest of a circuit of which that resistor is a part.
- The rate at which energy is delivered to a circuit by a seat of EMF.
- The rate at which electrical energy is converted to thermal energy in a circuit.
- The rate at which heat is given off by a resistor when the voltage across the resistor is, and has for a long time been, V and the current through the resistor is, and has for a long time been, I.
- The rate at which chemical energy is converted to electrical energy in a battery that is in a circuit.

Question 2 **10 points** Save

What are some of the differences between resistance and resistivity?

- Resistance can be used to characterize a given piece of wire whereas resistivity characterizes the material of which the wire is made.
- The resistance of a wire depends on what the wire is made of whereas the resistivity of the wire depends on how long it is.
- Resistance is measured in ohms whereas resistivity is measured in ohm's per meter.
- None of the other answers are correct.

Question 3 **15 points** Save

What is power? (Indicate all that apply.)

- The rate at which work is done.
- The rate at which energy is converted from one form to another form.
- The rate at which energy is delivered from one system to another system.
- The rate at which charge is delivered to a circuit by a seat of EMF.

Question 4 **20 points** Save

Wire A and wire B are both made out of copper. Both wires have the same length. The diameter of wire B is twice that of wire A.

- \- Which wire has the greater resistance?
- \- Which wire has the greater resistivity?

A. Wire A.
B. Wire B.
C. Neither.

Question 5 **20 points** Save

Wire A and wire B are both made out of copper. Wire B is twice as long as wire A. The diameter of wire B is twice that of wire A.

- Which wire has the greater resistance?	A. Wire A.
- Which wire has the greater resistivity?	B. Wire B.
	C. Neither.

Question 6 **10 points** Save

The power delivered to a 15 watt light bulb in normal operation is 15 watts. In normal operation, how much energy is delivered to such a bulb in an hour?

- 15 eV
- 15 J
- 9.00×10^2 J
- 54 kJ

Question 7 **10 points** Save

The resistance-per-length of a wire is the wire's resistivity.

- True
- False

Save Submit

Preview Assessment q11

Name: q11

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

Consider three resistors having three unique values of resistance. Suppose the resistors are connected in parallel with each other. Further suppose that the parallel combination of the three resistors is connected in a circuit such that at least some charge is flowing through each of the resistors. Which of the following statements is true? (Indicate all the correct answers.)

- ☐ The current through each resistor is one and the same value.
- ☐ The voltage across each resistor is one and the same value.
- ☐ The effective resistance of the combination of resistors is greater than the resistance of any one of the individual resistors.
- ☐ The effective resistance of the combination of resistors is less than the resistance of any one of the individual resistors.

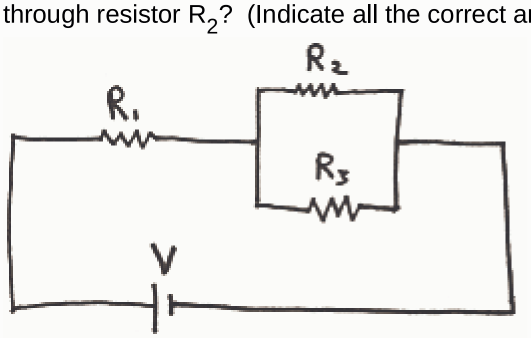
Question 2 **20 points** Save

Consider three resistors having three unique values of resistance. Suppose the resistors are connected in series with each other. Further suppose that the series combination of the three resistors is connected in a circuit such that at least some charge is flowing through each of the resistors. Which of the following statements is true? (Indicate all the correct answers.)

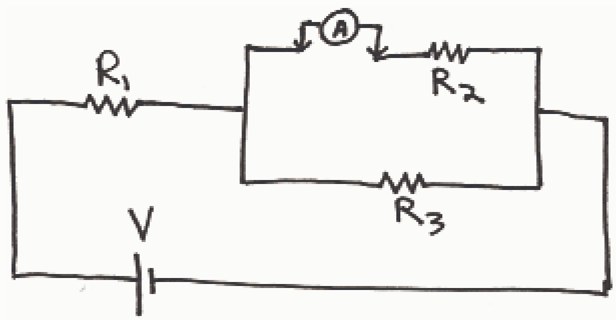
- ☐ The current through each resistor is one and the same value.
- ☐ The voltage across each resistor is one and the same value.
- ☐ The effective resistance of the combination of resistors is greater than the resistance of any one of the individual resistors.
- ☐ The effective resistance of the combination of resistors is less than the resistance of any one of the individual resistors.

Question 3 **20 points** Save

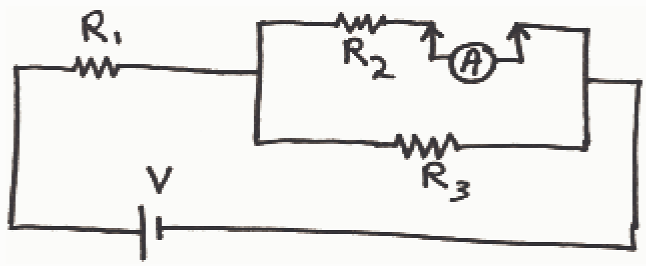
For this circuit, which of the following represents a correct way of connecting an ammeter to measure the current through resistor R_2? (Indicate all the correct answers.)



- ☐


A
R1
R2
R3
V

☐


R1
R2
A
R3
V

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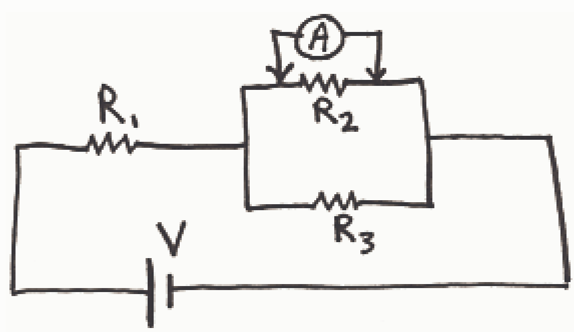
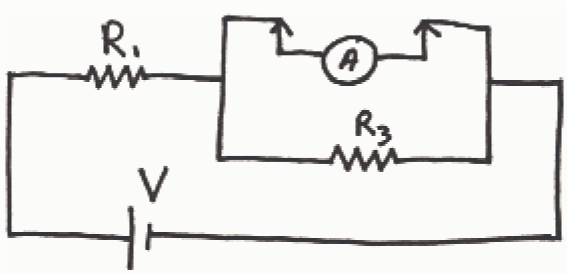
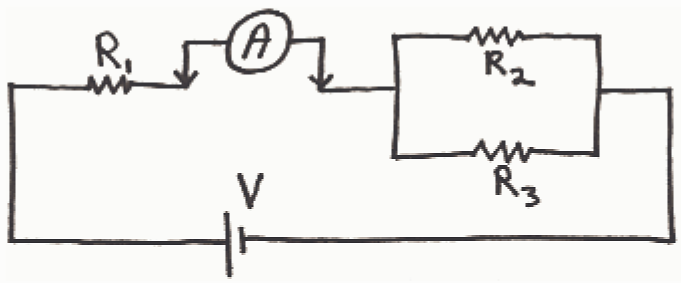

A
R1
R2
R3
V

☐

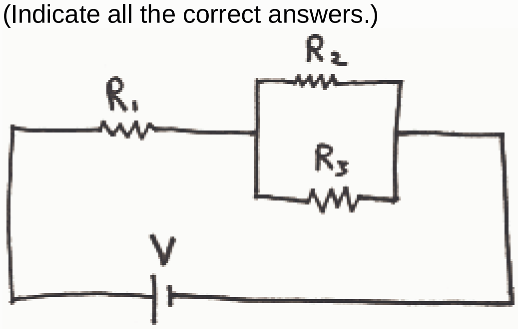

R1
A
R3
V

☐



Question 4 **10 points** Save

For this circuit, which of the following shows a correct way to connect a voltmeter to measure the voltage across R_2? (Indicate all the correct answers.)



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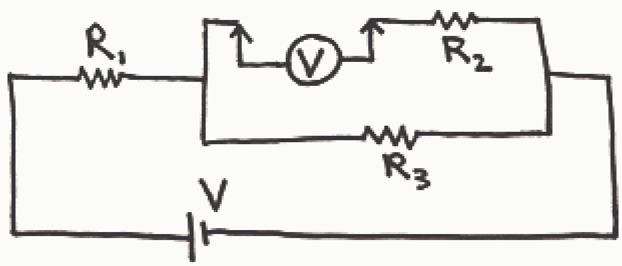

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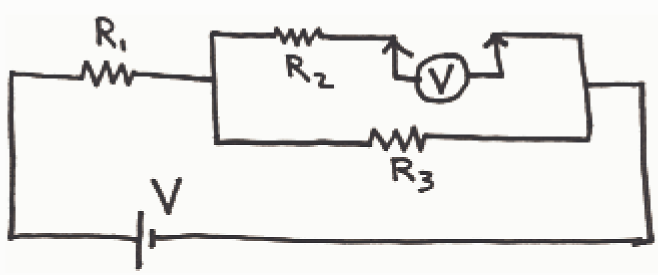

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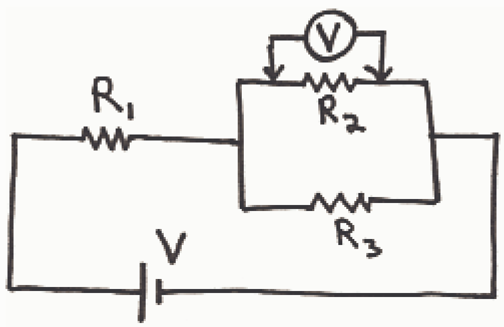

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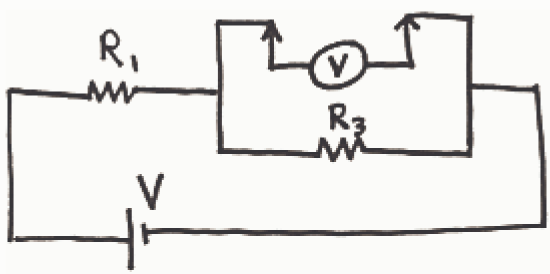

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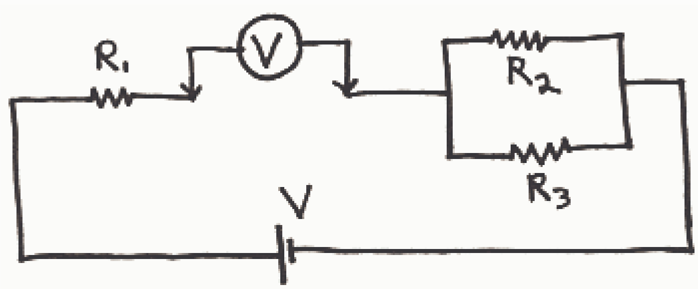


Question 5 **10 points** Save

A circuit consists of a 10 volt battery connected in series with a 4 ohm resistor and a 6 ohm resistor. A person calculates the current through the 4 ohm resistor using Ohm's Law by dividing 10 volts by 4 ohms. What is wrong with this?

- ◯ There is nothing wrong with it. That is exactly what one must do to get the current through the 4 ohm resistor.
- ◯ In using Ohm's Law to determine the current through a resistor, one must use the resistance of the resistor and the voltage across the resistor. One cannot just use any voltage that happens to appear in the circuit. 10 volts is not the voltage across the resistor.

Question 6 **10 points** Save

A circuit consists of a 10 volt battery connected in series with a 4 ohm resistor and a 6 ohm resistor. Why is it utter nonsense to say that 4 volts goes through the 4 ohm resistor? (Choose the one best answer.)

- ◯ Because the resistors are in series, the whole ten volts goes through each resistor.
- ◯ Voltage is potential difference. It doesn't ever go through anything. It doesn't "go" anywhere. It exists.
- ◯ The smaller the resistor the more voltage goes through it. More than half of the ten volts has to go through the smaller resistor.
- ◯ It is not utter nonsense. It is the truth.

Question 7 **10 points** Save

A seat of EMF is in series with a resistor R_1 and with a parallel combination of two other resistors R_2 and R_3. R_2 is a variable resistor whose resistance can be changed just by turning a knob. As the knob is turned to increase the resistance of R_2 what happens to the voltage across R_3?

- It increases.
- It decreases.
- It stays the same.

Save Submit

Preview Assessment q12

Name: q12

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

Match.

- \- The voltage across a resistor is directly proportional to the current through it.
- \- The sum of the voltage changes about any closed loop is zero.
- \- The sum of the currents into a junction is equal to the sum of the currents out of that junction.
- \- The force exerted on one charged particle by another is inversely proportional to the square of the separation of the two charged particles.

A. Ohm's Law
B. Bode's Law
C. Murphy's Law
D. Kirchoff's Voltage Law
E. Kirchoff's Current Law
F. Coulomb's Law

Question 2 **20 points** Save

An idealistic model for a battery is just an ideal seat of EMF. A more realistic model, commonly used to model actual batteries is:

- A resistor, known as the internal resistance of the battery, in series with an ideal seat of EMF.
- A resistor, known as the internal resistance of the battery, in parallel with an ideal seat of EMF.
- None of the other answers is correct.
- A capacitor charged to the extent that the voltage across its terminals is the rated voltage of the actual battery.

Question 3 **20 points** Save

In applying Kirchoff's voltage law, one draws a schematic diagram of the circuit and then indicates the current in each leg (a.k.a. branch) of the circuit. For each leg of the circuit, how does one know which way to draw the current.

- It doesn't matter which way one draws the current. One should just make a quick guess.
- One always knows the high (electric potential) terminal of each circuit element. The current always goes through a circuit element from the high side of the circuit element to the low side. One should draw the current arrows so as to depict the current going into the high side and out the low side of every circuit element.
- The current directions must always be given in any circuits problem. One should depict the currents to all be flowing in the given direction.
- None of the other answers is correct.

Question 4 **20 points** Save

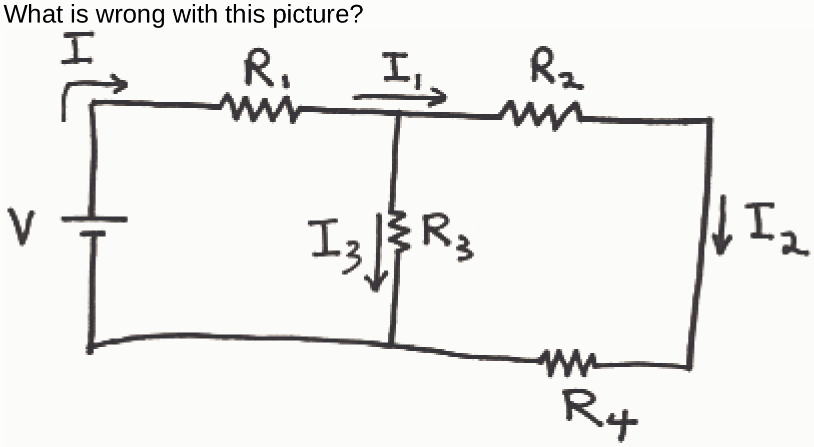
In using Kirchoff's Laws to analyze a circuit, a student correctly calculates a negative value for one of the currents in the circuit. What does the negative sign mean?

- One of the premises of the question is wrong. A negative sign for a current indicates that there is a mistake in the calculation.

- The positive sense for the current in question is established by means of an arrow pointing in that direction defined to be the positive direction for current. The negative sign in the result indicates that the current is actually in the direction opposite to that direction specified by the arrow.
- The negative sign has no significance. Sometimes currents come out positive and sometimes they come out negative. The only thing that matters is the absolute value of the current.
- None of the other answers is correct.

Question 5 **20 points** Save

What is wrong with this picture?



- I, I_1, and I_2 are all one and the same current.
- I and I_1 are one and the same current.
- I_1 should be depicted a going rightward and then downward toward R_3 rather than going rightward and then continuing rightward toward R_2.
- I_1 is depicted as going right through a junction. In actuality, where a current meets a junction (of three wires) part of the current goes one way and part of it goes another--it never just goes straight through the junction.

Save Submit

Preview Assessment q13

Name: q13

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

For the case of a capacitor which is initially charged and then connected across a resistor; the charge on the capacitor, the voltage across the capacitor, and the current through the resistor all decrease exponentially with time. What does it mean to say that any one of these quantities "decreases exponentially with time?"

- It means that the amount by which that quantity decreases in a second, increases with time. For instance, if the voltage across the capacitor decreases from 9.0 volts to 8.8 volts in one second starting at time 5.0 seconds, it might decrease from 5.0 volts to 4.0 volts in one second starting at time 25 seconds (where time 0 is the instant at which the charged capacitor is connected across the resistor).
- It means that the amount by which that quantity decreases in a second, decreases with time. For instance, if the voltage across the capacitor decreases from 9.0 volts to 7.4 volts in one second starting at time 5.0 seconds, it might decrease from 0.14 volts to 0.11 volts in one second starting at time 25 seconds (where time 0 is the instant at which the charged capacitor is first connected across the resistor).
- It means that one can define a half-life for the quantity where, the amount of charge the capacitor has on it for instance, at time t plus one half-life is one half the charge that it has on it at time t, no matter what time t you start with. Suppose for instance the capacitor has 12 microcoulombs of charge on it at time 2 seconds (with time 0 being the instant at which the charged capacitor is first connected across the resistor) and that the half-life is 4 seconds. Then at time t = 6 seconds, the charge on the capacitor will be 6 microcoulombs. Further if the charge on the capacitor is 1.5 microcoulombs at t = 13 seconds then once again it will be half that 4 seconds later, that is, the charge will be .75 microcoulombs at t = 17 seconds.
- It means that the amount by which the quantity decreases in a second is always the same no matter which second is under discussion. To illustrate, consider the current through the resistor. Suppose it is .25 amperes at time t = 2 seconds and decreasing at the rate of .01 amperes per second. Then at time t = 3 seconds the current will be .24 amperes. Further if the current is .07 amperes at t = 20 seconds, then it will be .06 amperes at time t = 21 seconds.
- None of the other answers are correct.

Question 2 **20 points** Save

A 12 volt battery is connected in series with an initially-uncharged 120 microfarad capacitor and a 25 ohm resistor. What is the current through the resistor at the instant the connection is made?

- 0 amperes
- 1.0 amperes
- 0.10 amperes
- .48 amperes
- 300 amperes

Question 3 **20 points** Save

Consider a capacitor which is charged to 12 volts and then connected across a resistor. Let $t_{1/2}$ be the time it takes for the voltage to drop down to 6 volts. Suppose the experiment is repeated, but with a pair of capacitors connected in parallel with each other in place of the original capacitor, where each element of the pair has the same capacitance as the original capacitor. How does the new $t_{1/2}$ compare with the original $t_{1/2}$?

- The new $t_{1/2}$ is the same as the original $t_{1/2}$.
- The new $t_{1/2}$ is twice the original $t_{1/2}$.
- The new $t_{1/2}$ is half the original $t_{1/2}$.
- The new $t_{1/2}$ is four times the original $t_{1/2}$.
- The new $t_{1/2}$ is one-fourth the original $t_{1/2}$.

Question 4 **20 points** Save

Consider a capacitor which is charged to 12 volts and then connected across a resistor. Let $t_{1/2}$ be the time it takes for the voltage to drop down to 6 volts. Suppose the experiment is repeated, but with a pair of capacitors connected in series in place of the original capacitor, where each element of the pair has the same capacitance as the original capacitor. How does the new $t_{1/2}$ compare with the original $t_{1/2}$?

- The new $t_{1/2}$ is the same as the original $t_{1/2}$.
- The new $t_{1/2}$ is twice the original $t_{1/2}$.
- The new $t_{1/2}$ is half the original $t_{1/2}$.
- The new $t_{1/2}$ is four times the original $t_{1/2}$.
- The new $t_{1/2}$ is one-fourth the original $t_{1/2}$.

Question 5 **20 points** Save

Consider a capacitor which is charged to 12 volts and then connected across a resistor. Let $t_{1/2}$ be the time it takes for the voltage to drop down to 6 volts. Suppose the experiment is repeated, but with a resistor whose resistance is twice that of the original resistor. How does the new $t_{1/2}$ compare with the original $t_{1/2}$?

- The new $t_{1/2}$ is the same as the original $t_{1/2}$.
- The new $t_{1/2}$ is twice the original $t_{1/2}$.
- The new $t_{1/2}$ is half the original $t_{1/2}$.
- The new $t_{1/2}$ is four times the original $t_{1/2}$.
- The new $t_{1/2}$ is one-fourth the original $t_{1/2}$.

Save Submit

Preview Assessment q14

Name: q14

Instructions:

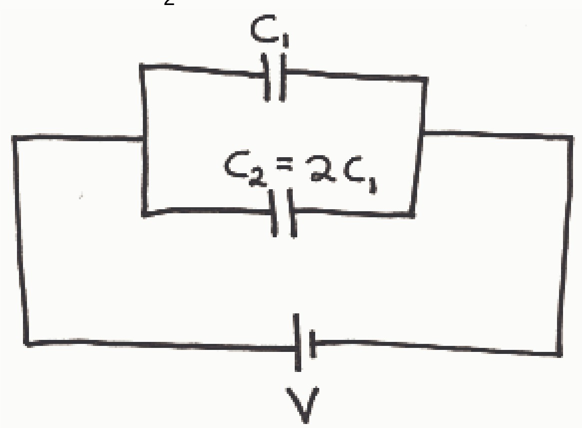
Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

A 12 Volt battery is connected across a parallel combination of two capacitors, C_1 and C_2. The capacitance of C_2 is twice that of C_2.

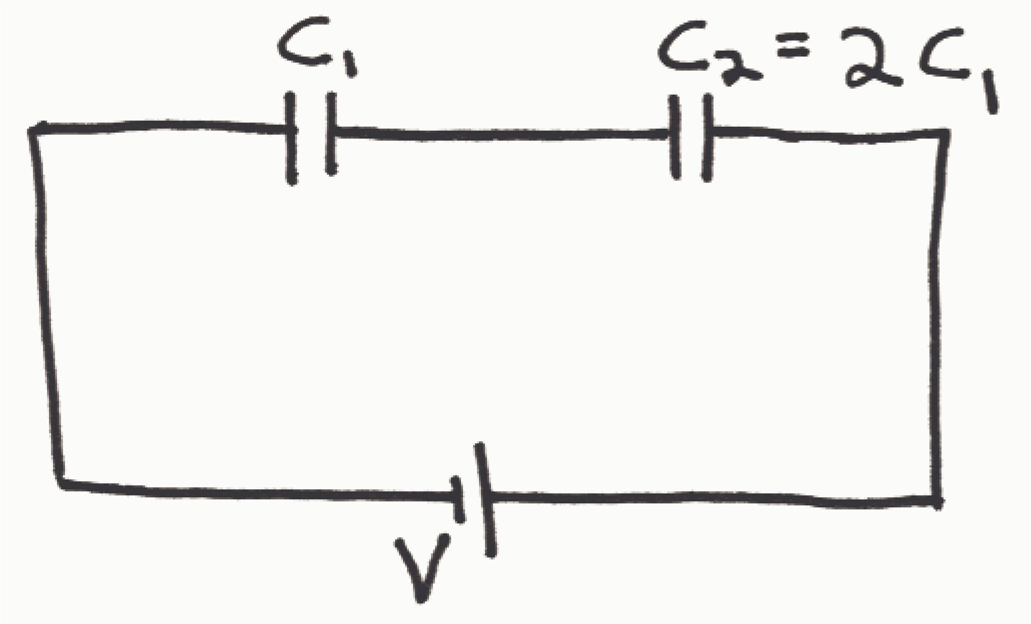


- Which capacitor has the greater charge?
- Across which capacitor is the voltage greater?

A. C_1
B. C_2
C. Neither. It is the same for both capacitors.

Question 2 **20 points** Save

A 12 volt battery is connected across a series combination of two capacitors, C_1 and C_2. The capacitance of C_2 is twice that of C_1.

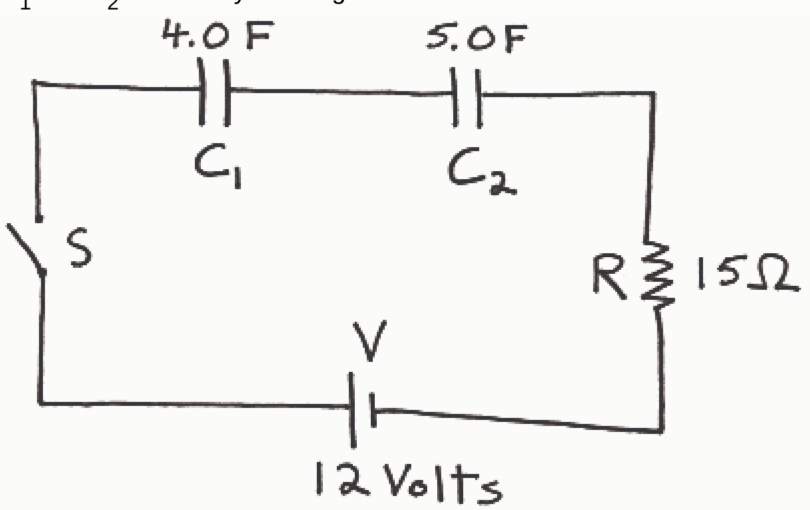


- Which capacitor has the greater charge?
- Which capacitor has the greater voltage?

A. C_1
B. C_2
C. Neither. They both have the same amount.

Question 3 **35 points** Save

C_1 and C_2 are initially uncharged.



- At the instant the switch is closed, what is the voltage across resistor R?
- At the instant the switch is closed, what is the current through resistor R?
- After the switch has been closed a very long time, so long that neither of the capacitors is still charging, what is the current through the resistor R?
- At the instant the switch is closed, what is the voltage across C_1?

A. 0 Volts
B. 5.3 Volts
C. 6.7 Volts
D. 12 Volts
E. 0 Amperes
F. 0.80 Amperes
G. 0 Coulombs
H. 27 Coulombs

- At the instant the switch is closed, what is the charge on C_1?
- After the switch has been closed a very long time, so long that neither of the capacitors is still charging, what is voltage across C_1?
- After the switch has been closed a very long time, so long that neither of the capacitors is still charging, what is charge on C_1?

I. 48 Coulombs

Question 4 **25 points** Save

Consider a pair of two identical capacitors. In which case is the capacitance of the pair greater?

- When they are connected in series with each other.
- When they are connected in parallel with each other.
- The capacitance is the same whether the capacitors are connected in series or in parallel with each other.
- None of the other answers is correct.

Save Submit

Preview Assessment q15

Name: q15

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **15 points** Save

Which of the following conditions must be met in order for a uniform magnetic field to exert a force on a particle?

- [ ] The particle must be charged.
- [ ] The particle must be moving in a direction that is neither parallel to nor anti-parallel to the magnetic field.
- [ ] The particle must be in the magnetic field.

Question 2 **20 points** Save

Which of the following is true of magnetic fields?

- [ ] Magnetic fields are invisible.
- [ ] A magnetic field can be caused to exist by a permanent magnet or by electric current.
- [ ] The effect of a magnetic field is to exert a torque on a bar magnet that is in the magnetic field (but not aligned with the magnetic field) and to exert a force on a charged particle that is moving in the magnetic field (as long as the velocity of the particle is neither parallel to nor anti-parallel to the magnetic field).
- [ ] A magnetic field is the association of a vector with each point in the region of space where the magnetic field exists.

Question 3 **20 points** Save

A positively-charged particle is moving southward in a downward-directed uniform magnetic field. The magnetic force is the only force, if any, acting on the particle. During the next few centimeters of its travel,

- ○ the particle speeds up.
- ○ the particle slows down.
- ○ the particle keeps on going with the same velocity.
- ○ the particle keeps on going at the same speed.

Question 4 **25 points** Save

A positively-charged particle is moving southward in a downward-directed uniform magnetic field. The magnetic force is the only force, if any, acting on the particle. What is the direction of the force exerted on the particle by the magnetic field?

- ○ Northward.
- ○ Southward.
- ○ Eastward.
- ○ Westward.

- Upward.
- Downward.
- There is no force exerted on the particle by the magnetic field.

Question 5 **20 points** Save

What is the defining effect of a magnetic field?

- It exerts a force on a charged particle at rest in the magnetic field.
- It exerts a torque on a magnetic dipole (bar magnet) that is in the magnetic field as long as the magnetic dipole is not aligned with the magnetic field.
- It attracts the north end of a bar magnet.
- It repels a magnetic dipole.

Save Submit

Preview Assessment q16

Name: q16

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

In depicting vectors in a diagram on a piece of paper,

- What is the symbol for a vector directed into the page?
- What is the symbol for a vector directed out of the page?

A. An "x" with or without a circle around it.
B. A dot with a circle around it.

Question 2 **20 points** Save

On a map, with northward being toward the top of the page on which the map is printed,

- Which way is eastward?
- Which way is southward?
- Which way is downward?
- Which way is upward?

A. Toward the top of the page.
B. Toward the bottom of the page.
C. Toward the right edge of the page.
D. Toward the left edge of the page.
E. Into the page.
F. Out of the page.

Question 3 **20 points** Save

A positively-charged particle is moving southward in a downward-directed uniform magnetic field. The magnetic force is the only force, if any, acting on the particle. Describe the trajectory of the particle assuming that it remains in the uniform magnetic field, and, that it's elevation does not change.

- The particle will keep on going straight for awhile and then begin to curve rightward.
- The particle will keep on going straight for awhile and then begin to curve leftward.
- The particle will curve rightward along a parabolic trajectory.
- The particle will curve leftward along a parabolic trajectory.
- The particle will travel clockwise, as viewed from above, around a horizontal circle.
- The particle will travel counterclockwise, as viewed from above, around a horizontal circle.

Question 4 **20 points** Save

A straight vertical wire passes through a wooden table top. The wire carries an upward directed current. The direction of the magnetic field of the wire at a point, on the table top, due south of the wire is:

- Counterclockwise as viewed from above.
- Clockwise as viewed from above.

- Upward.
- Downward.
- Northward.
- Southward.
- Eastward.
- Westward.
- None of the other answers is correct.

Question 5 **20 points** Save

The direction of the magnetic field at the center of a horizontal current-carrying loop of wire is straight downward. The magnetic field is caused by the current in the loop. What is the direction of the current?

- Counterclockwise as viewed from above.
- Clockwise as viewed from above.
- Upward.
- Downward.
- Northward.
- Southward.
- Eastward.
- Westward.

Save Submit

Preview Assessment q17

Name: q17

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

Indicate all that is wrong about the statement, "The magnetic field lines of a stationary bar magnet move from the north pole of the bar magnet to the south pole of the bar magnet."

- There is no such thing as a bar magnet.
- The magnetic field lines do not "move" anywhere. They exist. They do have some extent in space so we do say that they extend from here to there but it is incorrect to say that they move from here to there. One should not say that they "go" from here to there either.
- Outside the bar magnet the magnetic field lines do extend from north pole to south pole, but, inside the bar magnet, the magnetic field lines extend from south pole to north pole. Without stating the location of the magnetic field lines being characterized, the given statement is ambiguous.
- Magnets do not have north and south poles, they have positive and negative ends.

Question 2 **15 points** Save

Match the name of the phenomenon with the description of the phenomenon.

- \- The presence of a substance in a region of space makes it so that the magnetic field in that region of space is slightly stronger than it would be if the region of space was empty.
- \- The presence of a substance in a region of space makes it so that the magnetic field in that region of space is much stronger than it would be if the region of space was empty.
- \- The presence of a substance in a region of space makes it so that the magnetic field in that region of space is slightly weaker than it would be if the region of space was empty.

A. orthomagnetism
B. paramagnetism
C. ferromagnetism
D. diamagnetism

Question 3 **20 points** Save

A negatively charged particle is headed due north, straight toward a straight vertical wire which carries a downward current. What is the direction of the force, if any, exerted on the charged particle by the magnetic field of the current-carrying conductor?

- There is no force exerted on the charged particle.
- Northward.
- Southward.
- Eastward.
- Westward.
- Upward.

- Downward.
- None of the other answers is correct.

Question 4 **15 points** Save

The outer surface of a short, vertical segment of plastic pipe is hidden from view by wire wrapped around the pipe. Current flows clockwise, as viewed from above, in the wire. What is the direction of the magnetic field produced by the wire at a point inside the pipe?

- Radially outward from the axis of symmetry.
- Radially inward toward the axis of symmetry.
- Clockwise as viewed from above.
- Counterclockwise as viewed from above.
- The magnetic field is zero inside the pipe, so it has no direction.
- None of the other answers are correct.

Question 5 **15 points** Save

What is the direction of the magnetic field at a point due east of a straight wire carrying a current due north?

- Northward.
- Southward.
- Eastward.
- Westward.
- Upward.
- Downward.
- None of the other answers are correct.

Question 6 **15 points** Save

Where is the magnetic field due to a bar magnet strongest?

- At those points on that cyliner whose radius is equal to half the length of the magnet, which is centered on the center of the magnet, and, for which the magnet lies on the axis of symmetry of the cylinder.
- At points just outside the magnet that are closest to the center of the magnet.
- Inside the magnet.
- Just outside the magnet, at either end of the magnet.

Save Submit

Preview Assessment q18

Name: q18

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **30 points** Save

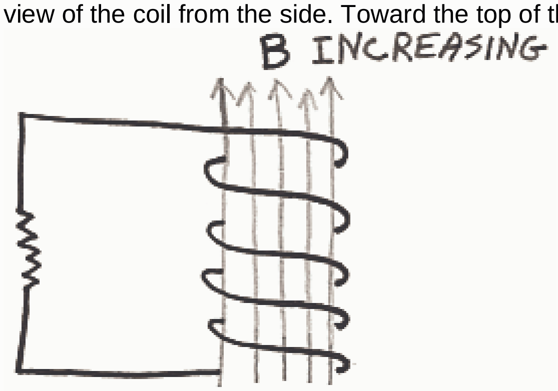
Match the Name of the Law to the Law.

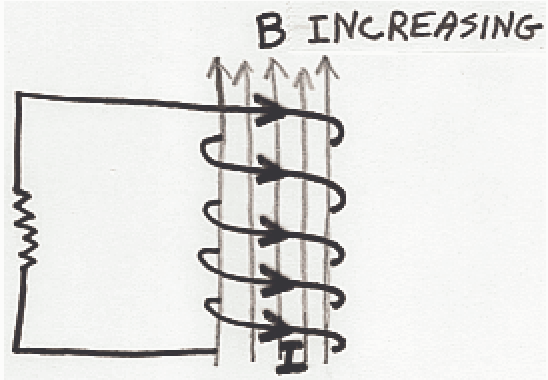
- Lenz's Law
- Ampere's Law
- Faraday's Law of Induction

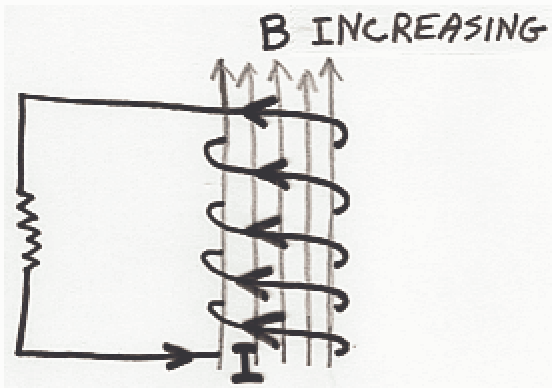
A. An electric current causes a magnetic field.
B. An electric current causes an electric field.
C. A changing number of magnetic field lines through a loop or coil induces a current to flow in that loop or coil.
D. A changing magnetic field causes an electric current.
E. The direction of the magnetic field caused by an electric current is opposite to the direction of the electric current.
F. The magnetic field produced by the current that is induced to flow in a loop or coil by a change in the number of magnetic field lines through that loop or coil is in that direction which tends to keep the number of magnetic field lines through the loop or coil at its original value in the original direction.

Question 2 **15 points** Save

Indicate the direction of the current, if any, induced to flow in the coil by the changing magnetic field. (Depicted is a view of the coil from the side. Toward the top of the screen in the diagram, is upward.)



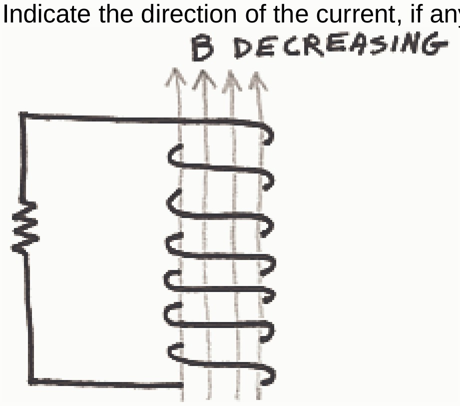


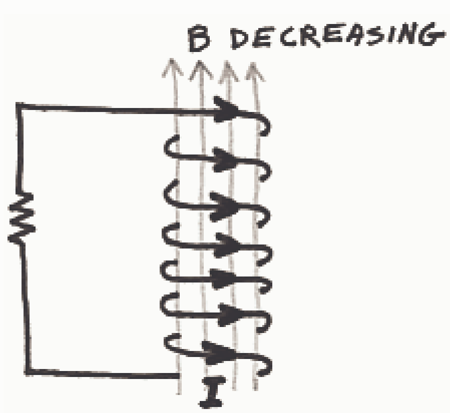


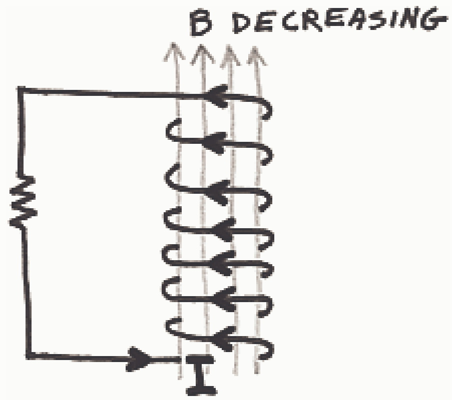
There is no current.

Question 3 **15 points** Save

Indicate the direction of the current, if any, induced to flow in the coil by the changing magnetic field.



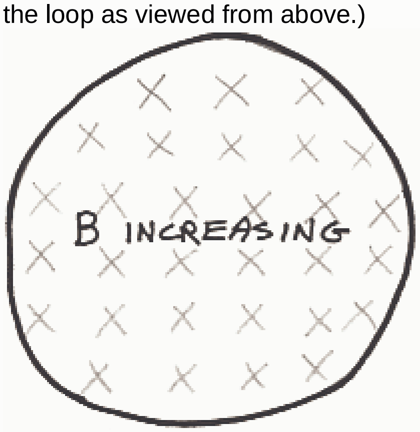


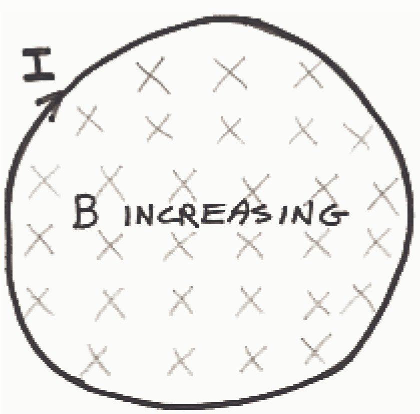


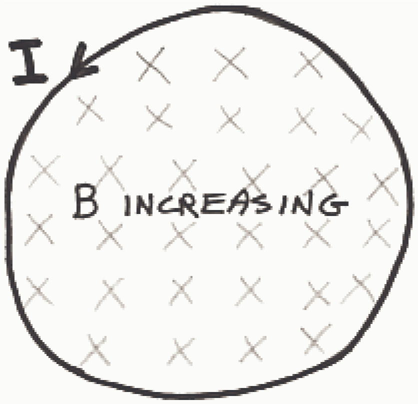
There is no current.

Question 4 **20 points** Save

Indicate the direction of the current, if any, induced to flow in the loop by the changing magnetic field. (Depicted is the loop as viewed from above.)



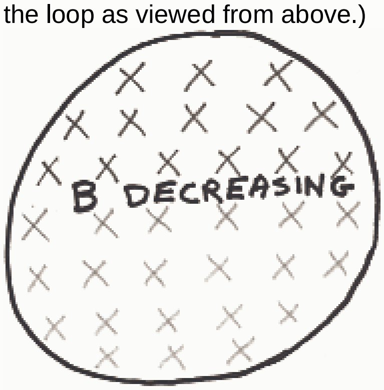




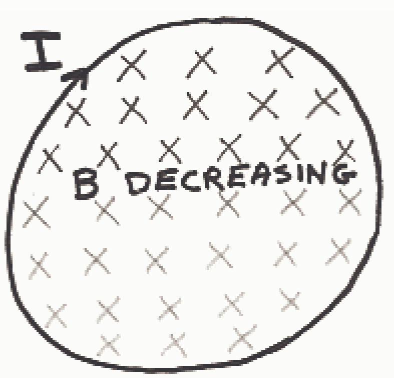
◯ There is no current.

Question 5 **20 points** Save

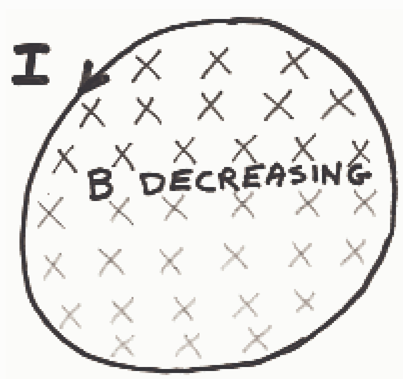
Indicate the direction of the current, if any, induced to flow in the loop by the changing magnetic field. (Depicted is the loop as viewed from above.)



◯



◯



- There is no current.

Save Submit

Preview Assessment q19

Name: q19

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

A bar magnet is suspended vertically above a closed coil of wire. The bar magnet is released. It remains vertical as it approaches the coil, falls straight through the coil, and then continues to fall downward, away from the coil. Does the direction of the current induced to flow in the coil as a result of the motion of the magnet reverse itself as the magnet passes through the coil?

- Yes.
- No.
- There is no current induced to flow in the coil.

Question 2 **20 points** Save

A bar magnet is suspended, north end up, well above a vertical coil of wire. The bar magnet is released. As it falls down toward the coil, it falls along a path that will take it straight through the coil. While it is falling downward toward the coil, is a current induced to flow in the coil as a result of the motion of the magnet?

- Yes.
- No.

Question 3 **20 points** Save

A long straight piece of wire carries an increasing current due northward. Due east of, and very near the straight wire, at the same height as that of the straight wire, is a stationary horizontal loop of wire. What is the direction of the current, if any, induced to flow in the loop?

- Northward.
- Southward.
- Eastward.
- Westward.
- Upward.
- Downward.
- Clockwise as viewed from above.
- Counterclockwise as viewed from above.
- No current is induced to flow in the loop.

Question 4 **20 points** Save

A wire loop and a bar magnet lie in one and the same horizontal plane. The bar magnet is outside of the loop. The bar magnet is spinning at a constant rate counterclockwise about a vertical axis through the center of the bar magnet. Consider an instant when the north pole of the bar magnet has just passed its closest point of approach to the loop and is distancing itself from the loop. At that instant, what is the direction of the current, if any, induced to flow in the loop?

- Upward.
- Downward.
- Clockwise as viewed from above.
- Counterclockwise as viewed from above.
- There is no current.

Question 5 **20 points** Save

A wire loop lies in a horizontal plane. Beside the loop is a vertical bar magnet, south end up. The bar magnet is bisected by the plane of the loop. A person is moving the bar magnet rapidly away from the loop. What is the direction of the current, if any, induced to flow in the loop?

- Upward.
- Downward.
- Clockwise as viewed from above.
- Counterclockwise as viewed from above.
- There is no current.

Save Submit

Preview Assessment q20

Name: q20

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

Explain what light is.

- Electric and magnetic fields that vary sinusoidally both as a function of time and as a function of position.
- Oscillating charged particles.
- That to which our eyes are sensitive.
- That which is given off by the sun.
- Electromagnetic Radiation

Question 2 **20 points** Save

What causes electromagnetic radiation (a.k.a. light, a.k.a. electromagnetic waves)? Choose the one BEST answer.

- Electric and magnetic fields that vary in time and space.
- Heat.
- Energy.
- Oscillating charged particles.

Question 3 **20 points** Save

What is the fundamental difference between X-rays and visible light?

- X-rays pass through human tissue but visible light does not.
- The sun gives off visible light rather than X-rays.
- X-rays travel faster than visible light.
- The frequency of X-rays is greater than that of visible light. Equivalently, the wavelength of X-rays is shorter than that of visible light.
- Eyes are sensitive to visible light but not to X-rays.

Question 4 **28 points** Save

Put the different kinds of light in order from lowest frequency to highest frequency.

- gamma rays
- X rays
- ultraviolet light
- visible light

- -
- - infrared radiation
- - microwaves
- - radio waves

Question 5 **12 points** Save

Light can travel through vacuum.

- True
- False

Save Submit

Preview Assessment q21

Name: q21

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

Electromagnetic radiation, a.k.a. light, consists of two kinds of fields each produced by the changing of the other. What are those two kinds of fields?

- [ ] Gravitational Fields
- [ ] Electric Fields
- [ ] Fields of Grass
- [ ] Magnetic Fields
- [ ] Meson Fields

Question 2 **20 points** Save

What are the angles between the direction of travel of light, the electric field, and the associated magnetic field?

- [ ] They are all in the same direction, hence the angles between them are all zero.
- [ ] The angle between the direction of travel and either field is always 90 degrees, but the angle between the electric field and the magnetic field can have any value.
- [ ] They are each at an angle of 90 degrees with respect to each of the other two.
- [ ] All the angles are arbitrary.

Question 3 **20 points** Save

What is the color of the shortest wavelength visible light?

- yellow
- violet
- green
- red

Question 4 **20 points** Save

What is the medium in which light waves travel?

- Air
- Ether
- Plasma
- Light requires no medium.

Question 5 **20 points** Save

What kind of waves are electromagnetic waves?

- Longitudinal Waves
- Compressional Waves
- Surface Waves
- None of the other answers is correct.

Save Submit

Preview Assessment q22

Name: q22

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **30 points** Save

In carrying out the Young's Double Slit experiment:

- What happens if the slit spacing is decreased?	A. The spacing between the bright fringes that appear on the screen decreases.
- What happens if the slit-to-screen distance is increased?	B. The spacing between the bright fringes that appear on the screen stays the same.
- What happens if the wavelength of the monochromatic light illuminating the double slit is increased?	C. The spacing between the bright fringes that appear on the screen increases.

Question 2 **10 points** Save

Are light waves the only kind of waves that undergo interference?

- Yes.
- No.

Question 3 **20 points** Save

In optics, what is meant by the expression "constructive interference."

- When light of one frequency, from two different sources, illuminates the same point in space, the electric field at that point in space is the vector sum of the electric field due to one source and the electric field do to the other. If the two electric fields are out of synchronization with each other they add up to a smaller electric field than that contributed by one of the sources by itself, resulting in light that is less intense than that due to the one source by itself. Constructive interference is the name given to this phenomenon.
- When light of one frequency, from two different sources, illuminates the same point in space, the electric field at that point in space is the vector sum of the electric field due to one source and the electric field do to the other. If the two electric fields are in synchronization with each other they add up to a bigger electric field than that contributed by either individual source, resulting in light that is more intense than that due to either source by itself. Constructive interference is the name given to this phenomenon.
- Constructive interference is the combining of different wavelengths of visible light to form white light.
- Constructive interference is when one ray of light gets in the way of another ray of light in such a manner as to construct a rainbow.

Question 4 **20 points** Save

What is monochromatic light?

- Light of a single wavelength.
- Light emitted by chromium gas.
- The opposite of stereographic light.

- ( )
- ( ) Collimated light traveling in a single direction.

Question 5 **20 points** Save

When white light is normally incident on a diffraction grating, the first order maximum for which color of light occurs at the greatest angle with respect to the straight ahead direction?

- ( ) white
- ( ) green
- ( ) red
- ( ) yellow
- ( ) violet

Save Submit

Preview Assessment q23

Name: q23

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **40 points** Save

In a diffraction experiment, monochromatic light which passes through a single slit illuminates a screen. A pattern of fringes appears on the screen. The pattern includes a central bright fringe. What happens to the width of the central bright fringe if the slit is replaced by a more narrow slit?

- The width of the central bright fringe decreases.
- The width of the central bright fringe increases.
- The width of the central bright fringe stays the same.
- None of the other answers are correct.

Question 2 **30 points** Save

Diffraction is a phenomenon that is strictly associated with light. That is to say that light, and, only light undergoes diffraction. (By light here, we mean any form of electromagnetic radiation--not just visible light.)

- True
- False

Question 3 **30 points** Save

Diffraction is the spreading of light that occurs when it pass through a thin slit or small hole or passes by an obstacle.

- True
- False

Save Submit

Preview Assessment q24

Name: q24

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **50 points** Save

In terms of the wavelength of the relevant light, how thick must the layer of transparent optical coating on a transparent medium be in order to create maximum destructive interference of the reflected light, thus maximizing transmission? (Choose the answer that is appropriate for the case in which light that is traveling in air is approaching a piece of glass along a path that is normal to the surface of the glass, and the coating, whose index of refraction is between that of air and that of glass, is to be placed on the first surface of the glass to be encountered by the light, in order to minimize reflection from that surface.)

- 0 wavelengths of the light in air.
- 1/4 wavelength of the light in air.
- 1/2 wavelength of the light in air.
- 1 wavelength of the light in air.
- 1/4 wavelength of the light in the transparent medium of which the optical coating is made.
- 1/2 wavelength of the light in the transparent medium of which the optical coating is made.
- 1 wavelength of the light in the transparent medium of which the optical coating is made.

Question 2 **50 points** Save

It is desired to minimize the reflection of light by the outer surfaces of the objective lenses of a pair of binoculars. These surfaces are the first surfaces that light hits on entering the binoculars. The lenses are made of crown glass. To minimize the reflection, the lenses should be coated with a transparent medium of the right thickness and of the right index of refraction. For maximum destructive interference of the reflected light, the value of the index of refraction of the coating:

- should be greater than that of crown glass.
- should be that value of index of refraction which is exactly midway between the value for air and that for crown glass.
- should lie between the index of refraction of air and that of crown glass, but closer to that of air than that of crown glass.
- should lie between the index of refraction of air and that of crown glass, but closer to that of crown glass than that of air.
- should be less than that of air.

Save Submit

Preview Assessment q25

Name: q25

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

(polarization) A polarizer consists of long-chain polymers aligned in a preferred orientation. How does that orientation compare with the direction of polarization of the polarizer?

- There is no correlation between the direction of polarization and the orientation of the polymers. The direction of polarization is established by means of a set of ruled, parallel, lines.
- The direction of polarization is the direction in which the long chained polymers are oriented.
- The direction of polarization is at right angles to the direction in which the long chained polymers are oriented.
- The direction of polarization is at an angle of 45 degrees with respect to the direction in which the long chained polymers are oriented.

Question 2 **20 points** Save

Completely unpolarized light of intensity I_o is incident on a polarizer whose polarization direction makes an angle of 15.0 degrees with respect to the vertical. What is the intensity of the light that makes it through the polarizer?

- 0
- .966 I_o
- .933 I_o
- .5 I_o
- I_o

Question 3 **20 points** Save

When light is vertically polarized, what is it about the light that is "vertical"?

- The direction of travel of the light.
- The orientation of the electric field--it is alternating between upward, zero, and downward.
- The orientation of the magnetic field--it is alternating between upward, zero, and downward.
- The direction in which the charged particles of which the light consists are oscillating.

Question 4 **20 points** Save

Which of the fields that make up light interact most strongly with matter?

- The football field.

- The electric field.
- The magnetic field.

Question 5 **20 points** Save

Why are polarized sunglasses effective?

- Light which undergoes plane mirror reflection from various horizontal parts of the surface of the earth, is horizontally polarized. Such light is glare. It has a "blinding" effect which makes it difficult for one to see clearly. The "lenses" of polarized sunglasses are vertically polarized. As such they tend to absorb the glare. They let the vertically polarized light, resulting from diffuse reflection and necessary for seeing anything, through. To be sure, half the diffusely reflected light itself is horizontally polarized, and it is absorbed by the lenses too. This results in a dimming of the view, a side effect.
- Light which undergoes plane mirror reflection from various horizontal parts of the surface of the earth, is vertically polarized. Such light is glare. It has a "blinding" effect which makes it difficult for one to see clearly. The "lenses" of polarized sunglasses are horizontally polarized. As such they tend to absorb the glare. They let the horizontally polarized light, resulting from diffuse reflection and necessary for seeing anything, through. To be sure, half the diffusely reflected light itself is vertically polarized, and it is absorbed by the lenses too. This results in a dimming of the view, a side effect.
- Each "lens" of a pair of polarized sunglasses consists of a layer of two polarizers oriented at 90 degrees with respect to each other. This results in substantial dimming of the view through the sunglasses on a bright, bright, bright, sunshiny day.
- Each "lens" of a pair of polarized sunglasses is a polarizer. The orientation of the polarizer is not relevant to the function of the sunglasses. Light impingent on the polarizer is randomly polarized. Half that light is absorbed by the polarizer and the other half, the light that is polarized in the same direction as the polarizer, gets through. The result is a 50% reduction in the intensity of the light resulting in more comfortable viewing.

Save Submit

Preview Assessment q26

Name: q26

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **24 points** Save

For a plane mirror, which is true of the normal?

- [ ] It is at right angles to the surface of the mirror.
- [ ] It is normal to the surface of the mirror.
- [ ] It is perpendicular to the surface of the mirror.
- [ ] It makes an angle of 90 degrees with the surface of the mirror.
- [ ] It is an imaginary line.
- [ ] It passes through the point of incidence.
- [ ] It is the line with respect to which the angle of incidence is measured.
- [ ] It is the line with respect to which the angle of reflection is measure.

Question 2 **20 points** Save

A person is attempting to locate the image of an object of a plane mirror by means of a ray-tracing diagram. The person draws a ray, from the object, which strikes the mirror at right angles to the surface of the mirror. Where does the ray go from there?

- ○ It reverses its direction at the surface of the mirror and travels straight back upon itself.
- ○ It continues along a straight line path straight through the mirror.
- ○ It travels downward along the surface of the mirror, stops for gas at the intersection of the principal axis of the mirror and the plane of the mirror, and then makes tracks for New York city.
- ○ It reflects off the surface of the mirror so that it crosses the principal axis of the mirror at an angle equal to the angle it (the reflected ray) makes with the incident ray.

Question 3 **20 points** Save

According to the law of reflection, the angle of reflection is equal to the angle of incidence. An angle is always an angular separation between two planes, a direction and a plane, or two directions. The angle of reflection is the angle between what and what?

- ○ The incident ray and the plane of the mirror.
- ○ The incident ray and the reflected ray.
- ○ The reflected ray and the plane of the mirror.
- ○ The reflected ray and the normal.

Question 4 **16 points** Save

Assuming that it is understood that the object is in front of the mirror and anything on the other side of the mirror is behind the mirror, is the following statement sufficient to unambiguously specify the correct location of the image, formed by a plane mirror, of that object?

"The image is exactly as far behind the mirror as the object is in front of the mirror."

- ◯ Yes.
- ◯ No.

Question 5 **20 points** Save

In forming the image, does light from the object necessarily pass through the location of the image?

- ◯ Yes.
- ◯ No.
- ◯ Only after dark.
- ◯ Only if the object is a vampire.

Save Submit

Preview Assessment q27

Name: q27

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

A ray of light in air is incident upon a flat piece of glass. How does the path that the light travels along when it is in the glass compare with the path in the air?

- The light does not enter the glass.
- The light travels along the same straight line path whether it is in the air or in the glass.
- The path in the glass makes a smaller angle with the normal.
- The path in the glass makes a larger angle with the normal.

Question 2 **20 points** Save

A ray of light, traveling in air, passes through a flat plate of glass. Refraction occurs. Where does the refraction take place?

- In the glass.
- At the glass-to-air interface where the light enters the glass only.
- At the glass-to-air interface where the light exits the glass only.
- In the air.
- At the glass-to-air interface where the light enters the glass, and, at the glass-to-air interface where the light exits the glass.
- In the air and in the glass.

Question 3 **20 points** Save

A ray of white light in air passes through a glass plate. Refraction occurs. The direction in which the light is traveling changes. For what color of light is the change in direction greater, red or blue?

- That depends on which interface is under consideration. On passing from air to glass, the blue light is refracted more (experiences the bigger change in direction of travel). But, in going from glass to air, the red light is refracted more.
- That depends on which interface is under consideration. On passing from air to glass, the red light is refracted more (experiences the bigger change in direction of travel). But, in going from glass to air, the blue light is refracted more.
- The blue light is refracted more (experiences the bigger change in direction of travel) at both interfaces.
- The red light is refracted more (experiences the bigger change in direction of travel) at both interfaces.

Question 4 **20 points** Save

On passing from a medium with one index of refraction to a medium with a different index of refraction, light is typically both reflected and refracted. Under some circumstances however, all of the light is reflected—none of it gets through the interface. The phenomenon is called "Total Internal Reflection." In which case, if either, can total internal reflection occur—when light is already in the medium with the greater index of refraction and encounters the boundary between the two media, or, when light is already in the medium with the smaller index of refraction and encounters the boundary between the two media?

- When light is already in the medium with the greater index of refraction and encounters the boundary between the two media.
- When light is already in the medium with the smaller index of refraction and encounters the boundary between the two media.
- Depending on the angle of incidence, it can happen in either case.
- Neither.

Question 5 **20 points** Save

The index of refraction of a particular medium is almost the same for all wavelengths, hence we often associate a single value, the average value of the index of refraction, to the medium. There is, however, some variation in the value of the index of refraction, with wavelength. As a result the angle of refraction that occurs when light enters or exits such a medium is slightly different for different wavelengths of visible light. What is the name of this phenomenon?

- Diffraction.
- Interference.
- Refraction.
- Dispersion.
- Dirovariance.

Save Submit

Preview Assessment q28

Name: q28

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

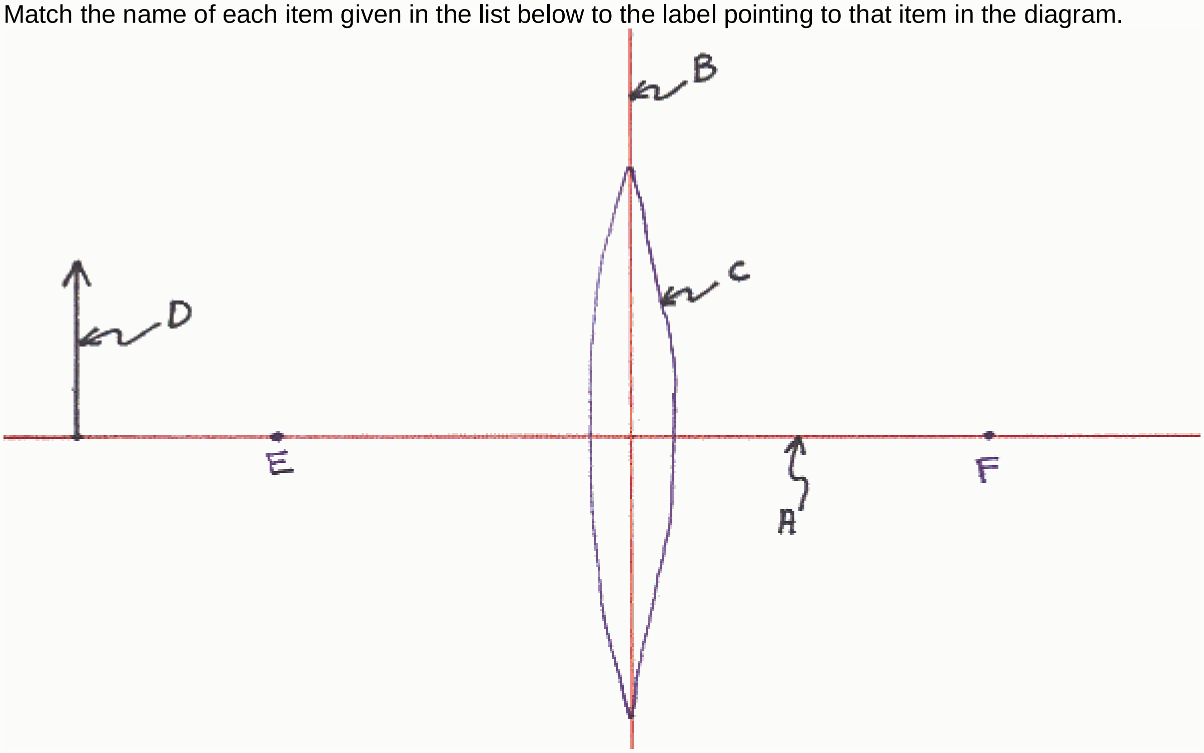
Question 1 **9 points** Save

Which of the following is a principal ray for the case of an actual physical object and a convex (converging) lens? Indicate all that apply.

- ☐ A ray departing from the object along a line parallel to the principal axis of the lens, at the plane of the lens, adopts a path that takes it through the focal point on the other side of the lens.
- ☐ A ray departing from the object along a line parallel to the principal axis of the lens, at the plane of the lens, adopts a path along the line that passes through the focal point on the same side of the lens as the object.
- ☐ A ray departing from the object along a line that takes it through the center of the lens, at the plane of the lens, continues along that same path.
- ☐ A ray departing from the object along a line that pass through the focal point on the other side of the lens, at the plane of the lens, adopts a path parallel to the principal axis of the lens.
- ☐ A ray departing from the object along a line passing through the focal point on the same side of the lens as the object, at the plane of the lens, adopts a path parallel to the principal axis of the lens.

Question 2 **18 points** Save

Match the name of each item given in the list below to the label pointing to that item in the diagram.

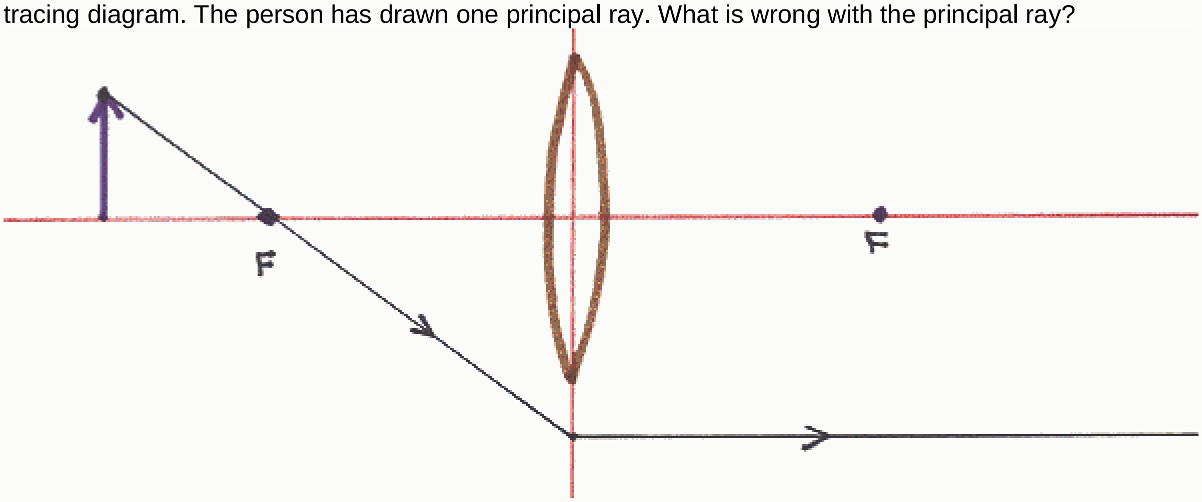


- That focal point on the opposite side of the lens as the object. A.

-	That focal point on the same side of the lens as the object.	B.
-	The plane of the lens.	C.
-	The principal axis of the lens.	D.
-	An icon representing the lens.	E.
-	The object.	F.

Question 3 **9 points** Save

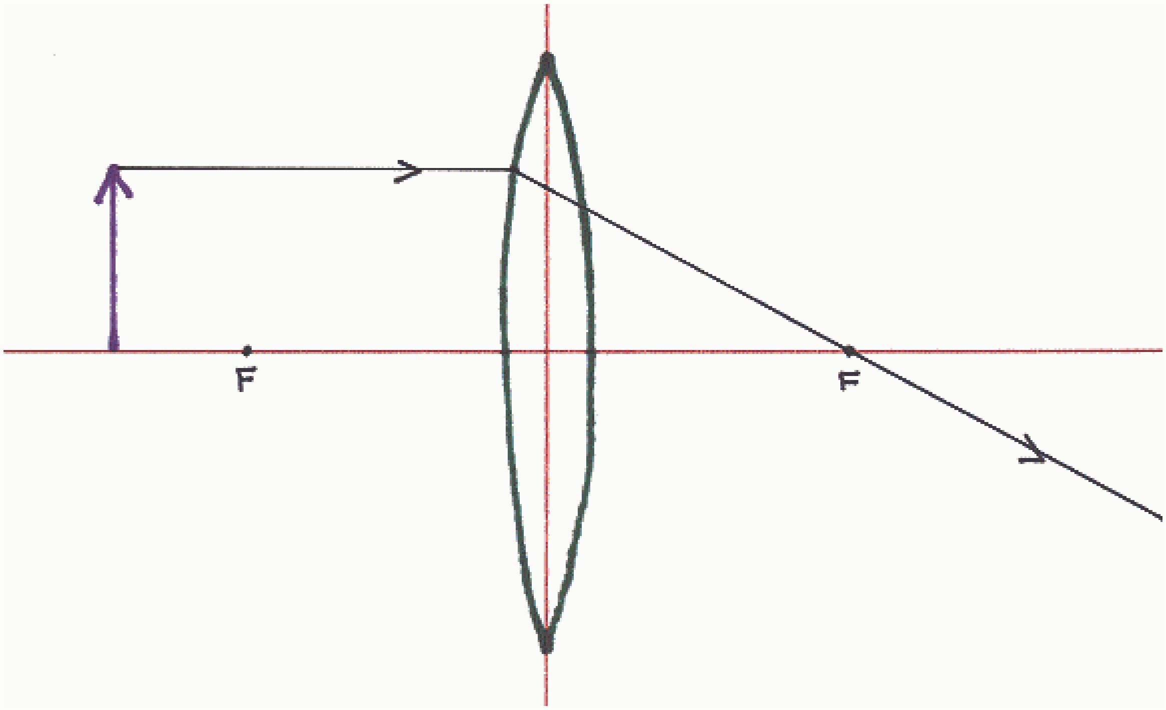
A person is attempting to determine the characteristics of an image formed by a converging lens by means of a ray tracing diagram. The person has drawn one principal ray. What is wrong with the principal ray?



- Nothing.
- It doesn't hit the lens.
- There is no principal ray that goes through the focus on the same side of the lens as the object.
- At the plane of the lens, the ray should adopt a straight path that takes it through the focal point on the other side of the lens.
- No one of the other answers is correct.

Question 4 **9 points** Save

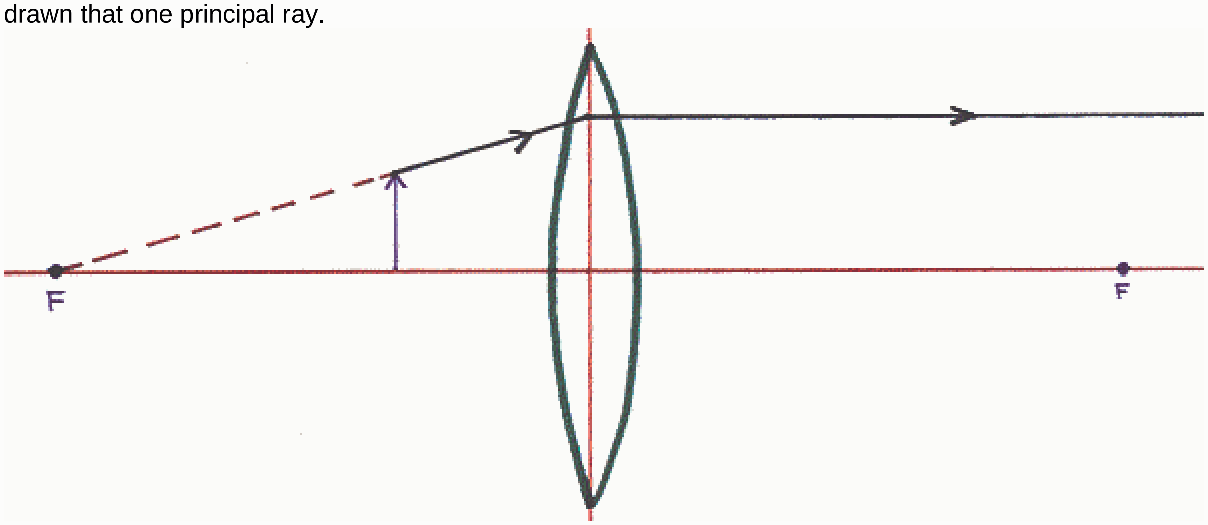
A person is creating a ray tracing diagram to determine the characteristics of an image formed by a converging lens. So far, the person has gotten as far as drawing one of the principal rays. What is necessarily wrong with the ray tracing diagram so far?



- Nothing is necessarily wrong with the diagram so far.
- Both focal points are depicted as being the same distance from the plane of the lens. This is never the case. One of the focal points has to be farther from the plane of the lens than the other.
- The principle ray is depicted as changing its path at the surface of the lens. In the thin lens approximation central to thin lens ray tracing diagrams, the change of path is supposed to occur at the plane of the lens.
- The principal ray depicted, on passing through the lens, is supposed to diverge from the principal axis of the lens. The person shows it converging toward the principal axis of the lens.
- None of the other answers is correct.

Question 5 **9 points** Save

A person is determining the characteristics of the image formed by a converging lens by means of a ray tracing diagram. The person has gotten as far as drawing one principal ray. What is wrong with the way the person has drawn that one principal ray.



- Nothing.
- The person has attempted to draw a principal ray collinear with a line passing through the focal point on the same side of the lens as the object. When the object is closer to the lens than the focal point, there is no such

principal ray.

- ◯ The principal ray the person is attempting to depict is supposed to go toward the focal point and then through it. The person has depicted the ray as being directed away from the focal point.
- ◯ At the plane of the lens the ray should adopt a path which takes it through the focal point on the other side of the lens.
- ◯ No one of the other answers is correct.

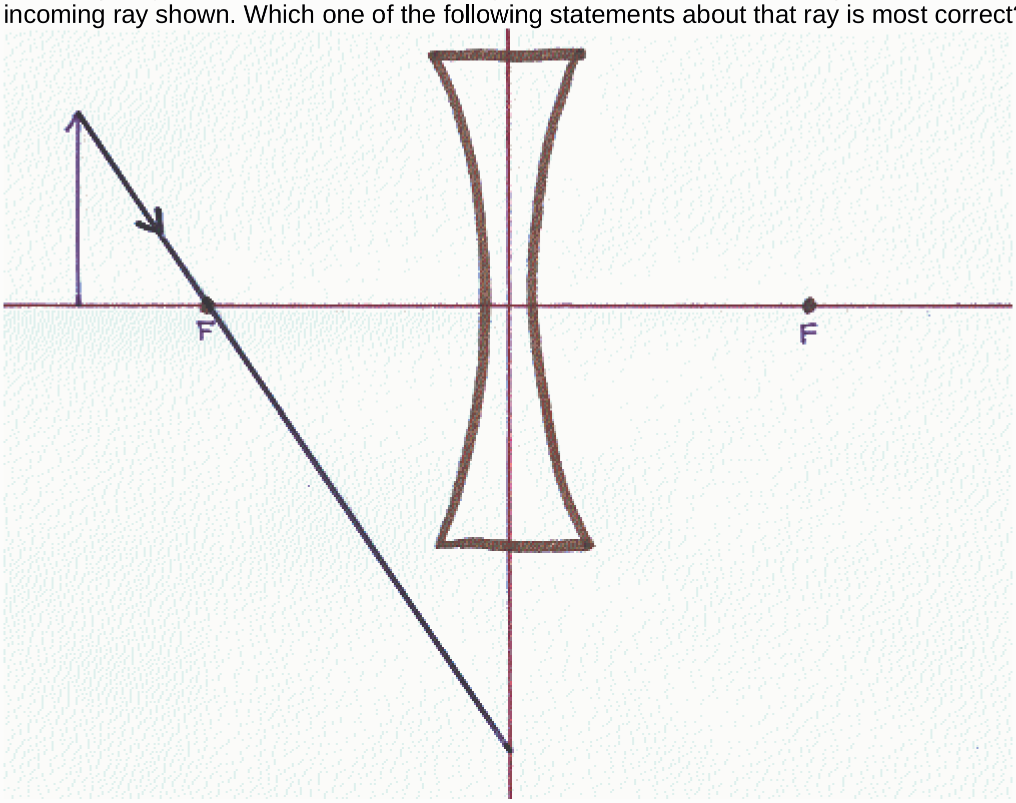
Question 6 **9 points** Save

Which of the following is a principal ray for the case of an actual physical object and a concave (diverging) lens? Indicate all that apply.

- ☐ A ray departing from the object along a line parallel to the principal axis of the lens, at the plane of the lens, adopts a path that takes it through the focal point on the other side of the lens.
- ☐ A ray departing from the object along a line parallel to the principal axis of the lens, at the plane of the lens, adopts a path along the line that passes through the focal point on the same side of the lens as the object.
- ☐ A ray departing from the object along a line that takes it through the center of the lens, at the plane of the lens, continues along that same path.
- ☐ A ray departing from the object along a line that passes through the focal point on the other side of the lens, at the plane of the lens, adopts a path parallel to the principal axis of the lens.
- ☐ A ray departing from the object along a line passing through the focal point on the same side of the lens as the object, at the plane of the lens, adopts a path parallel to the principal axis of the lens.

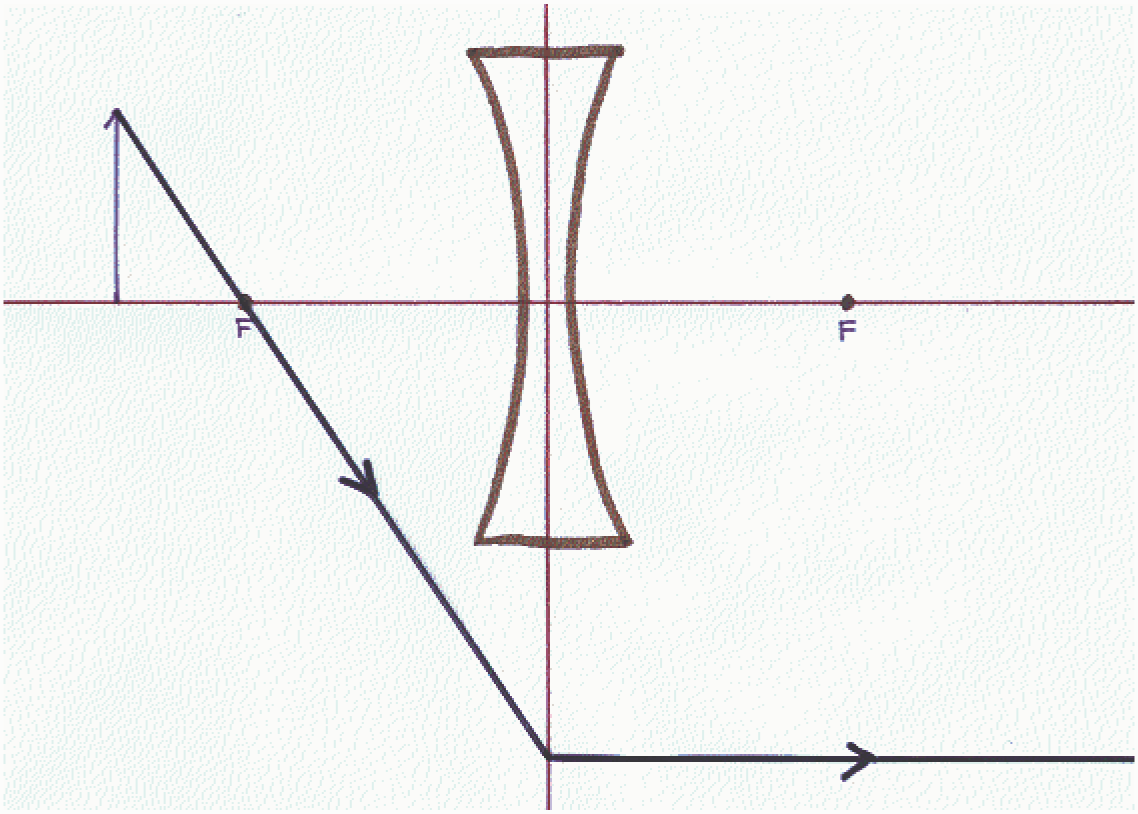
Question 7 **9 points** Save

A person is tasked with creating a ray diagram to determine the characteristics of the image, of an object, formed by a concave lens. The person has correctly drawn the principal axis of the lens, the plane of the lens, the object, a lens icon to specify the kind of lens, and correctly drawn and labeled the focal points. Then the person draws the incoming ray shown. Which one of the following statements about that ray is most correct?

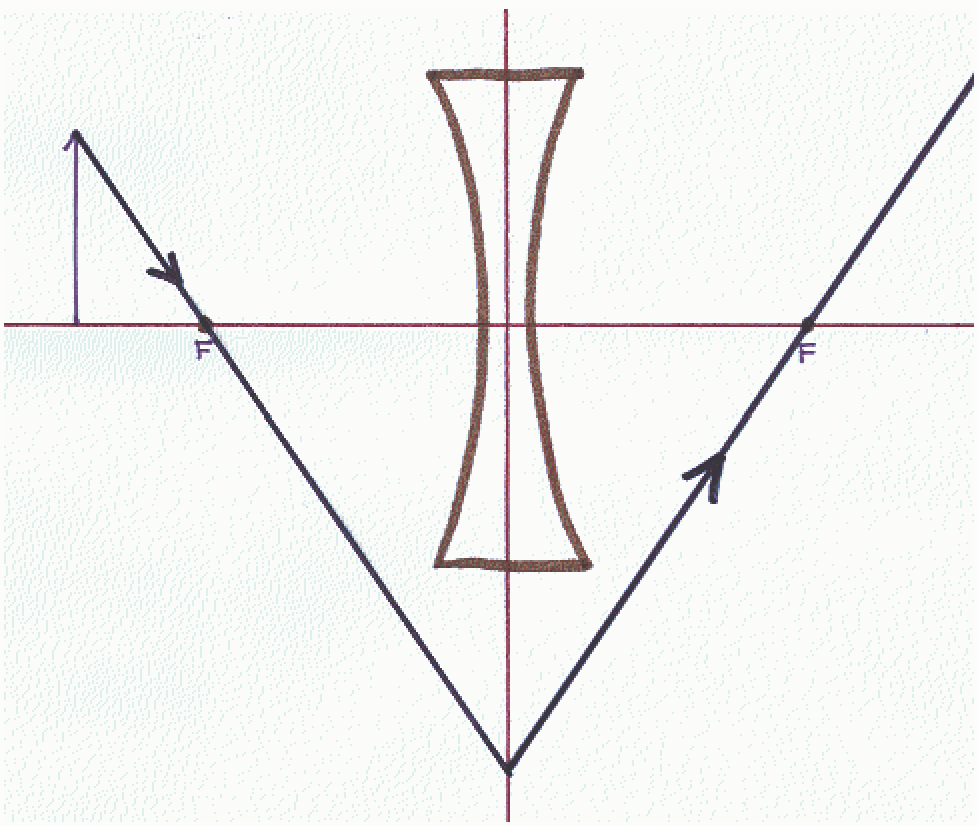


- ◯ That ray is not a principal ray.
- ◯ It is a principal ray, but, it misses the lens and is therefore of no use in determining the location of the image.

For purposes of determining the location of the image, the ray is to be drawn as if it continues as shown here:



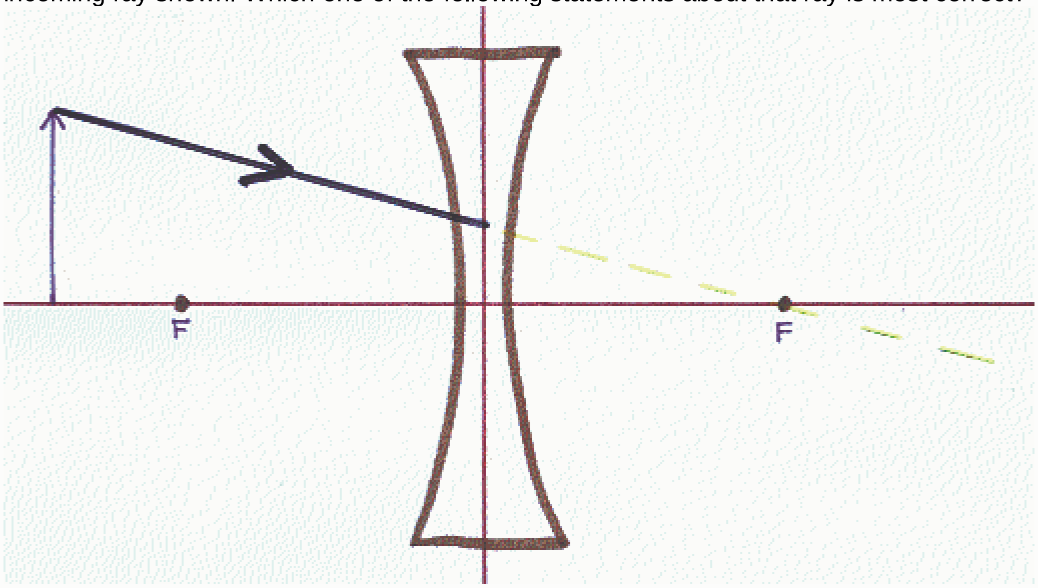
For purposes of determining the location of the image, the ray is to be drawn as if it continues as shown here:



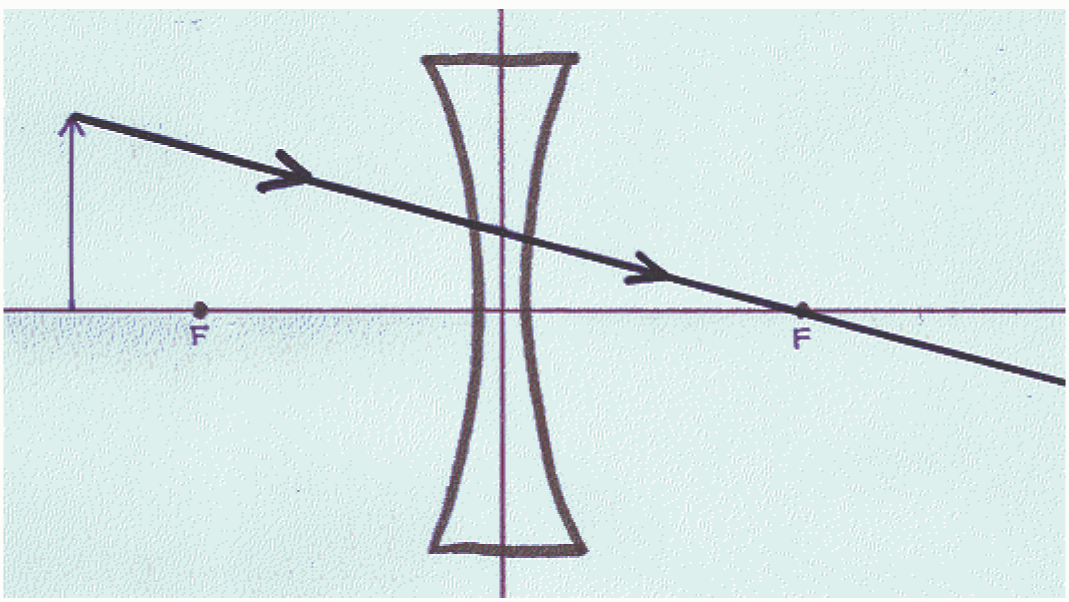
None of the other answers is correct.

Question 8 **9 points** Save

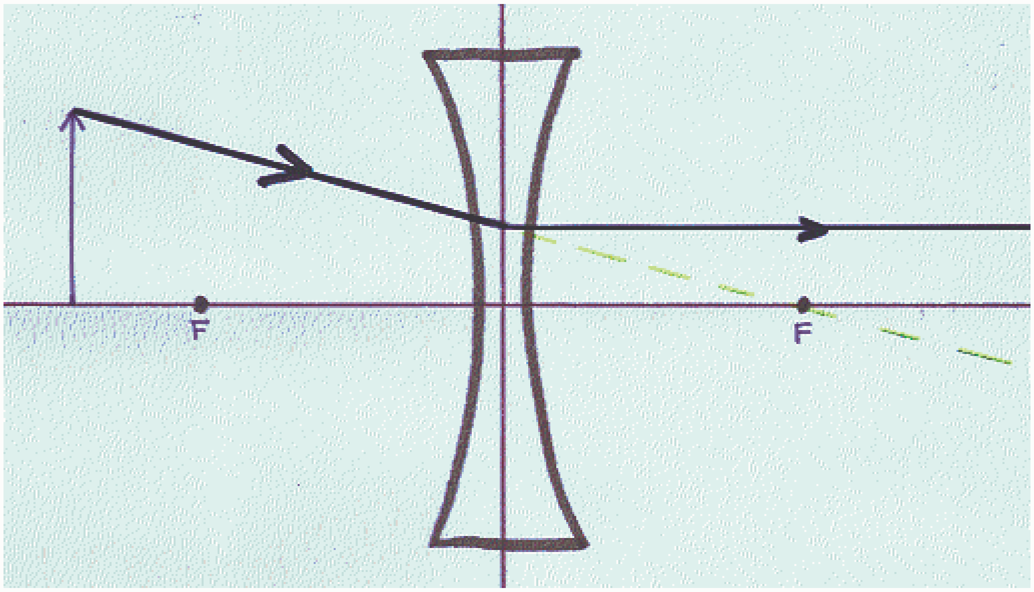
A person is tasked with creating a ray diagram to determine the characteristics of the image of an object formed by a concave lens. The person has correctly drawn the principal axis of the lens, the plane of the lens, the object, a lens icon to specify the kind of lens, and correctly drawn and labeled the focal points. Then the person draws the incoming ray shown. Which one of the following statements about that ray is most correct?



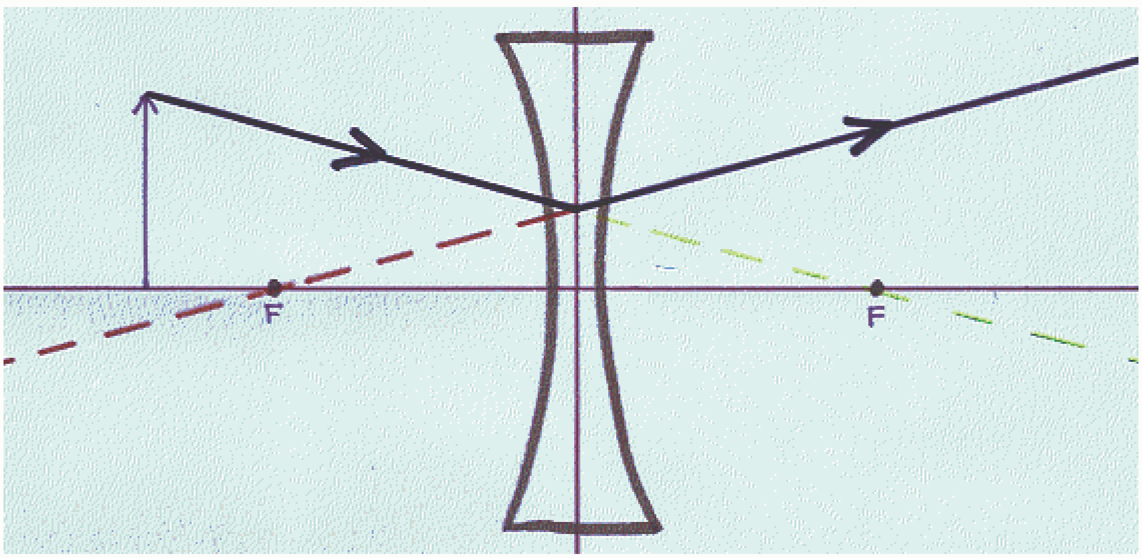
- That ray is not a principal ray.
- For purposes of determining the location of the image, the ray is to be drawn as if it continues as shown here:



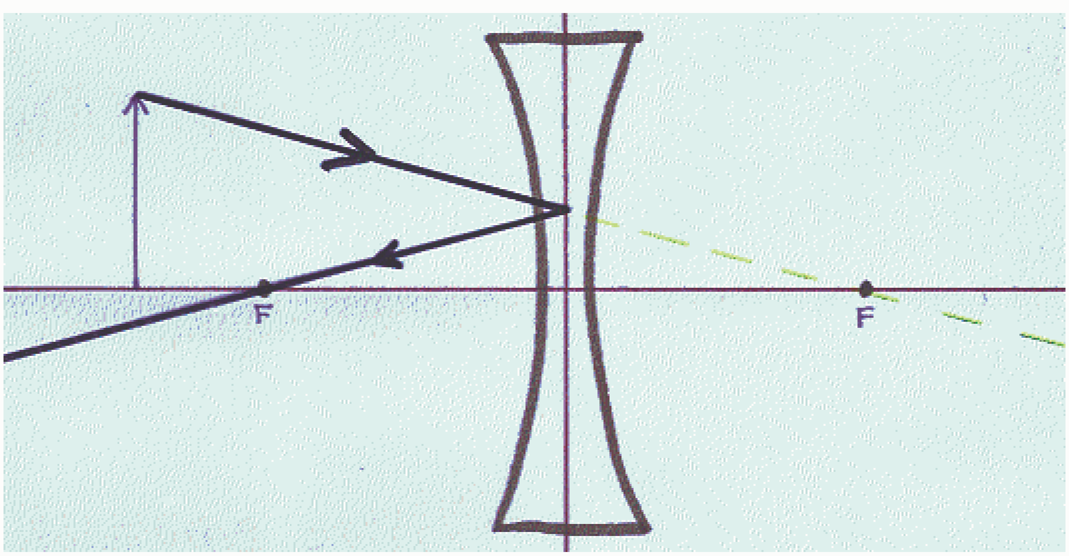
- For purposes of determining the location of the image, the ray is to be drawn as if it continues as shown here:



For purposes of determining the location of the image, the ray is to be drawn as if it continues as shown here:



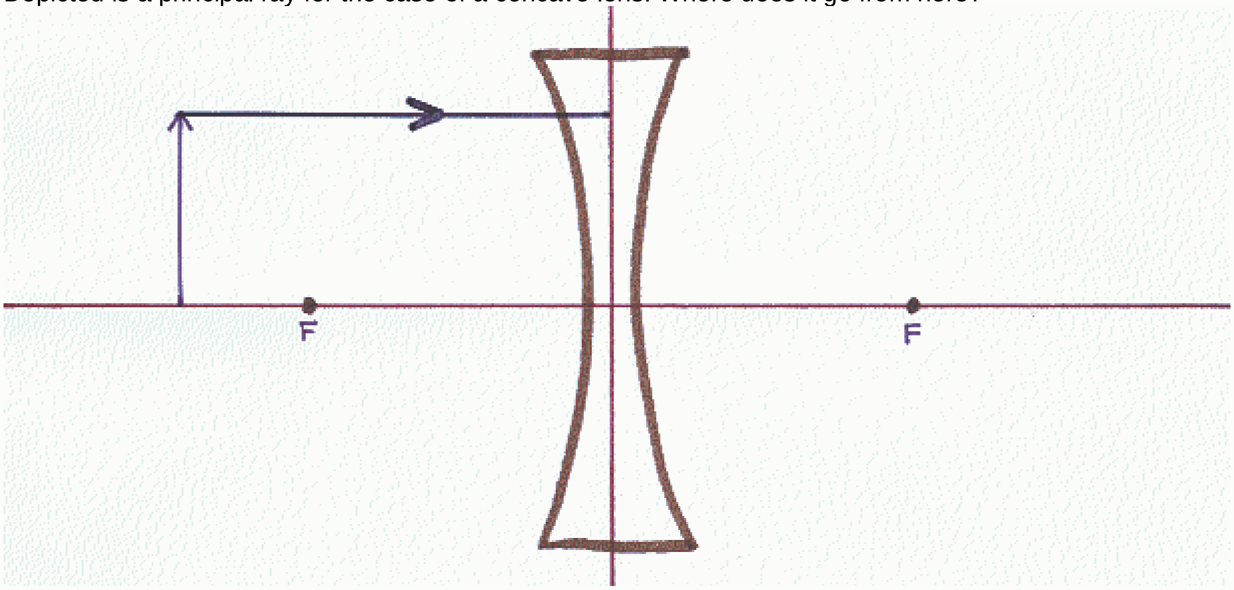
For purposes of determining the location of the image, the ray is to be drawn as if it continues as shown here:

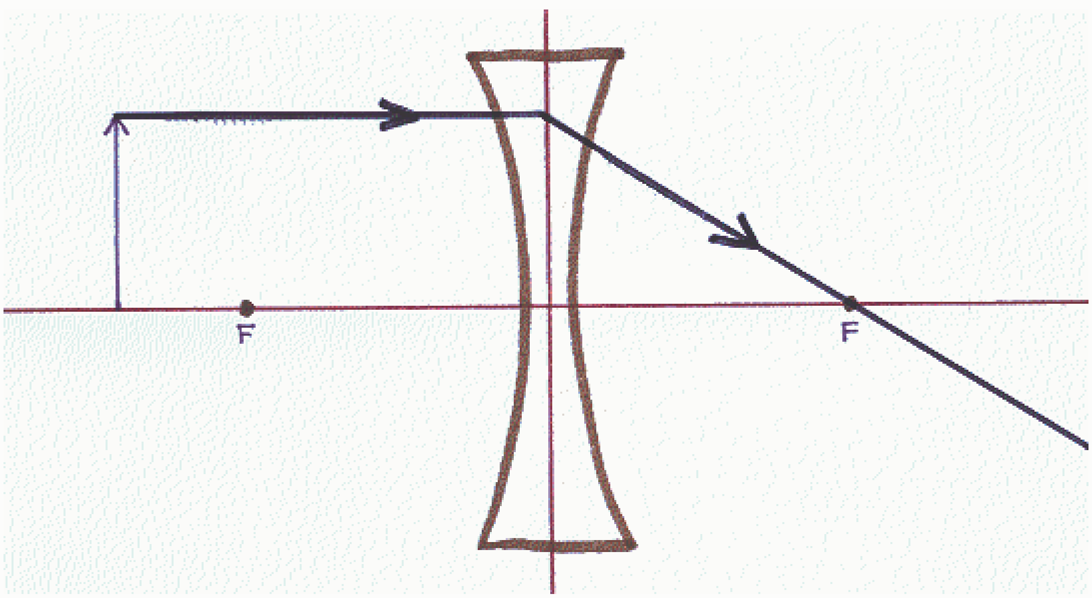


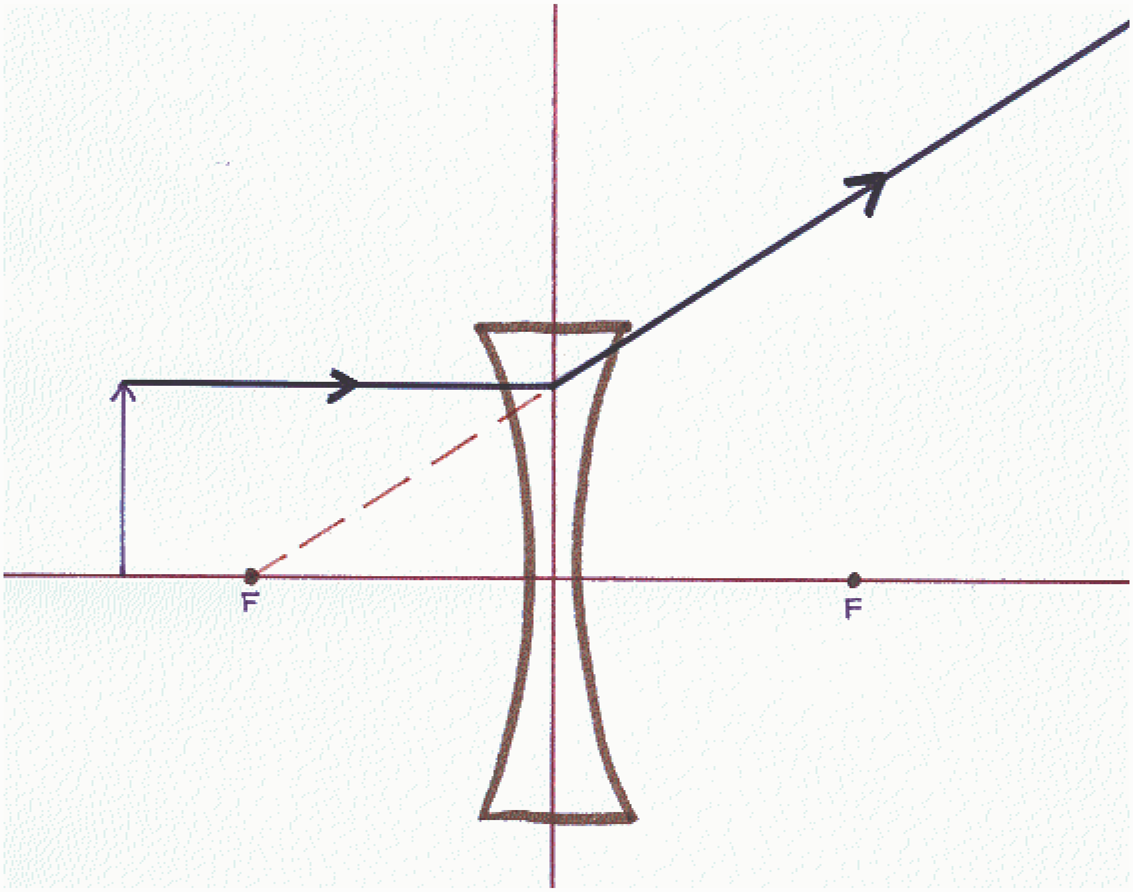
None of the other answers is correct.

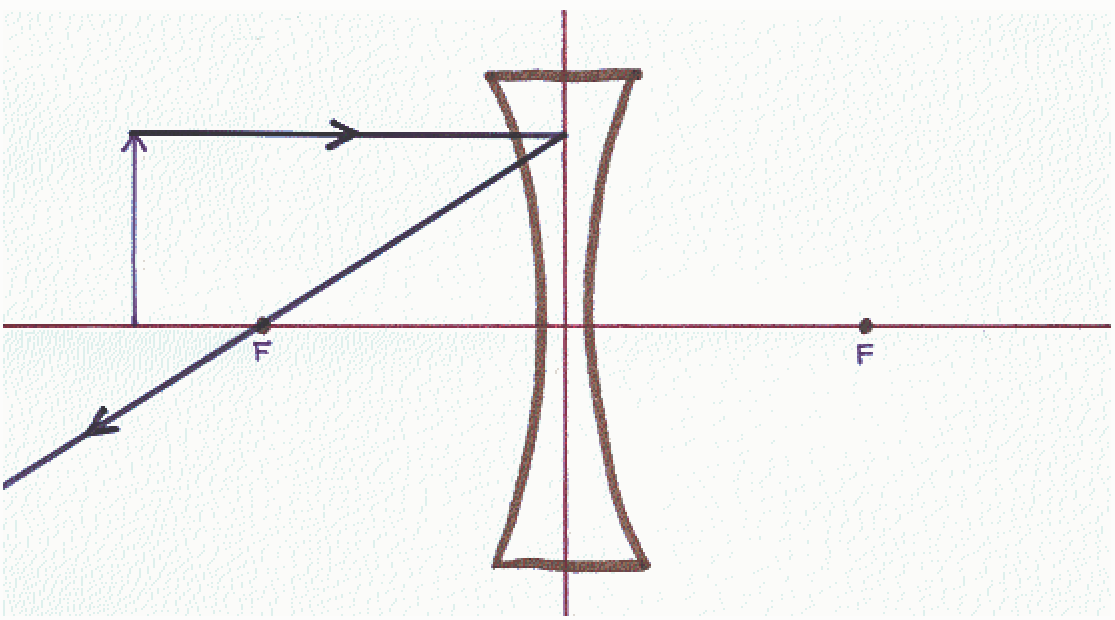
Question 9 **9 points** Save

Depicted is a principal ray for the case of a concave lens. Where does it go from here?





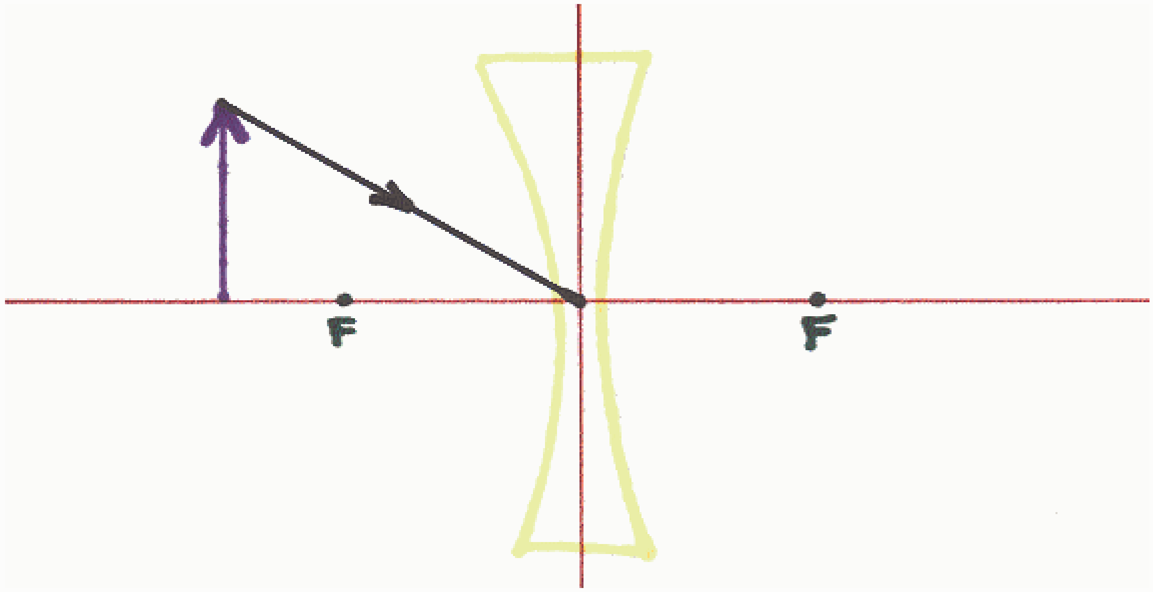




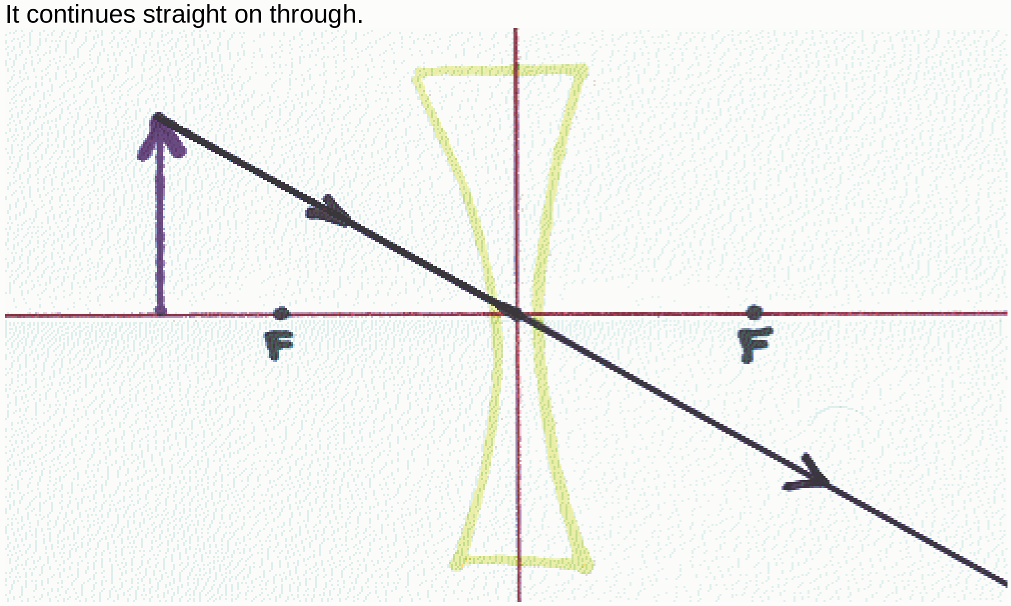
None of the other answers is correct.

Question 10 **10 points** Save

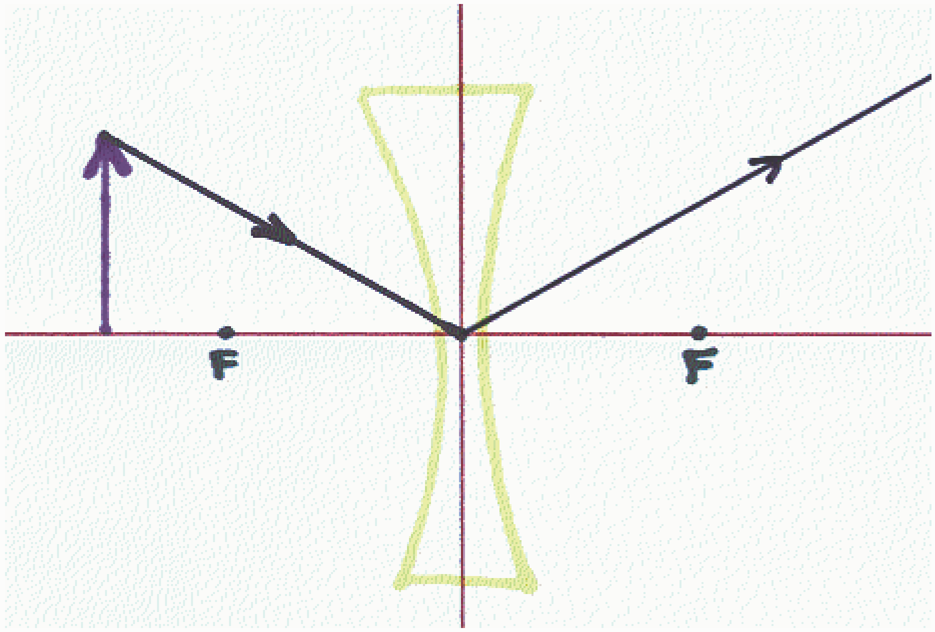
Depicted is a ray from an object which heads toward and then into a lens. If the ray is a principal ray, where does it go from there?



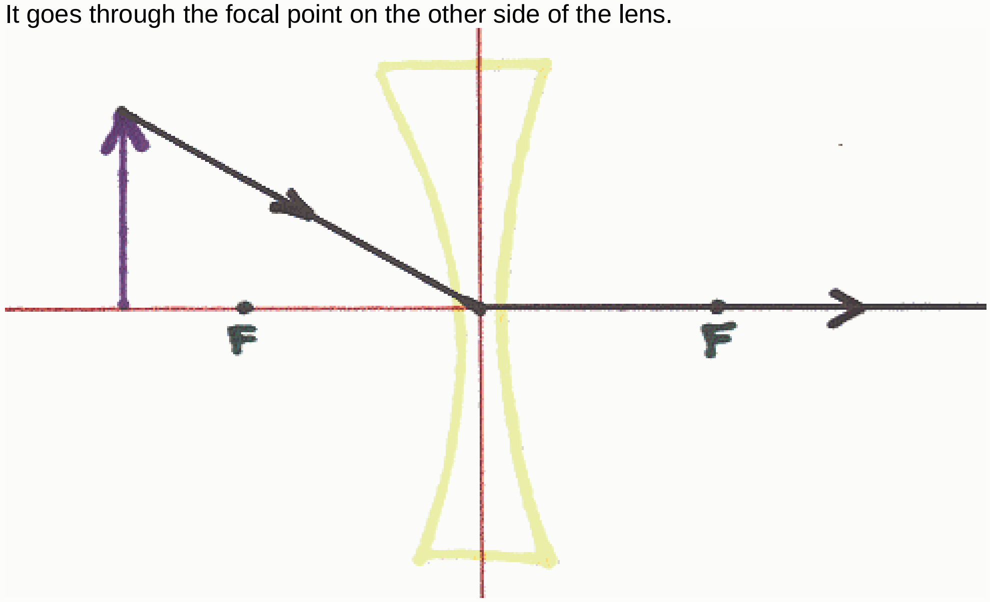
- It is not a principal ray.
- It continues straight on through.



- It adopts a path that makes the same angle with the principal axis of the lens as the incoming ray does.



◯ It goes through the focal point on the other side of the lens.



◯ None of the other answers is correct.

Save Submit

Preview Assessment q29

Name: q29

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

A single lens is used to form an image of an actual physical object. You calculate the image position *i* and find that it has a negative value. What does the negative sign tell you about the image? Indicate all that apply.

- [ ] It is real.
- [ ] It is virtual.
- [ ] It is inverted.
- [ ] The image is on that side of the lens which is opposite to the side of the lens the object is on.
- [ ] The image is on the same side of the lens as the object.

Question 2 **20 points** Save

Suppose you are asked to find the characteristics of the image of an actual physical object formed by a single lens and you obtain a negative value for the magnification. What does this tell you about the image? (Indicate all that apply.)

- [ ] It is smaller than the object.
- [ ] It is larger than the object.
- [ ] It is inverted.
- [ ] It is erect.
- [ ] It is virtual.
- [ ] It is on the same side of the lens as the object.

Question 3 **20 points** Save

Match.

- Has a negative focal length.
- Has a positive focal length.
- Causes light to diverge.
- Causes light to converge.

A. a concave lens
B. a convex lens

Question 4 **20 points** Save

Suppose that you are asked to find the image position in a problem involving a lens. You are given the object position and you are told that the lens is a concave lens whose focal point is 12 cm from the plane of the lens. What value should you use for the focal length f of the lens?

- .012 m
- .12 m
- -.012 m
- -.12 m

Question 5 **20 points** Save

Which is true of the light from an actual physical object whose image is formed by a single thin lens?

- The rays of light coming from the object diverge as they approach the lens.
- The rays of light coming from the object converge as they approach the lens.
- The rays of light coming from the object neither diverge nor converge as they approach the lens.
- In some cases, the rays of light coming from the object diverge as they approach the lens, and in other cases they converge as they approach the lens. Not enough information is given to establish which is the case here.

Save Submit

Preview Assessment q30

Name: q30

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

What is linear charge density? (Choose the one BEST answer.)

- It is the charge density that lies along a line.
- It is the total charge of an object divided by the length of that object.
- In the case of a distribution of charge in which all the charge is on a line, it is the total amount of charge on that line divided by the length of the line.
- In the case of a distribution of charge in which all the charge is on a line, it is the charge-per-length characterizing any element of the line (with units of Coulombs per meter).

Question 2 **20 points** Save

A linear charge distribution of linear charge density $\lambda(x')$ extends from $x'=0$ to $x'=L$ on the x-axis of a Cartesian coordinate system. A student is asked to find the electric field as a function of x, valid for points on the x-axis at points for which $x > L$.

Notes:

a) x' and x are both used as the position variable for points on the x-axis. x' is used to specify the position of a bit of the charge that is causing an electric field to exist elsewhere, whereas x is used to specify the location at which the electric field (due to all the charge) is being calculated.

b) $\lambda(x')$ is to be read "lambda of x-prime" indicating that the linear charge density is a function of position.

The student arrives at the following integral for the x-component of the electric field at x, in the course of solving the problem:

$$E_x(x) = k\int_0^L \frac{\lambda(x')}{(x-x')}$$

Is there anything that is obviously wrong with the integral?

- Yes.
- No

Question 3 **20 points** Save

Suppose you are asked to find the electric field at point P, whose coordinates are (L,y) for the case of a uniform line segment of charge, which extends from x=0 to x=L on the x axis of a Cartesian coordinate system. One must integrate Coulombs law for the electric field at point P due to each charge dq on the line segment. In the denominator of the integrand is a the square of a distance (written as r^2 in Coulomb's Law). In Coulombs law for the electric field due to a point charge, the distance in question is the distance from the point charge to the point in space at which the electric field is being calculated. What distance do we use for the distance in question in the integrand?

- The distance from the left end of the linear charge distribution to point P.
- The distance from the center of the linear charge distribution to point P.
- The distance from the right end of the linear charge distribution to point P.
- None of the above.

Question 4 **20 points** Save

In calculating the electric field, at some point P in the x-y plane of a Cartesian coordinate system, due to a linear charge distribution in the x-y plane, each contribution to the electric field at point P, from each infinitesimal element of the charge distribution, is a vector.

Hence, to find the total electric field $\vec{E}$, one must do a vector sum of an infinite number of infinitesimal vectors $d\vec{E}$. How does one deal with such an enormous vector addition problem?

- The premise of the question is wrong. The electric field is a scalar, not a vector.
- One integrates the contributions to the magnitude of the electric field to find the magnitude of the total electric field and then uses common sense to determine the direction of the electric field.
- All the $d\vec{E}$'s are in the same direction. Adding vectors that are in one and the same direction is just like adding scalars. So, in calculating the total electric field $\vec{E}$, one does not have to concern oneself with the fact that $\vec{E}$ is a vector.
- None of the other answers is correct.

Question 5 **20 points** Save

A student is asked to find the x-component of the electric field on the x-axis, due to charge Q that is uniformly distributed along a line segment that extends along the y-axis from y=0 to y=L. The student has worked hard to arrive at the expression

$$E_x = \int_0^L k \frac{Q}{L(y' + x)} dy'$$

and would like to do a quick check to see if it has the right units before actually doing the integral. (If the units don't work out, the expression is wrong.) Is there such a check, and, if so, does the check show that the expression has the correct units or does it show that the expression has the incorrect units?

- No. One cannot check the units in the given expression.
- Yes. One can do a units check. The expression passes the units check.
- Yes. One can do a units check. The expression fails the units check.

Save Submit

Preview Assessment q31

Name: q31

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

In terms of the conventional graphical representation of an electric field, which of the following conceptual statements best represents what is meant by "the electric flux through a closed surface"?

- It is the algebraic sum of the number of electric field line passages through the surface where a passage of one line through the surface counts as +1 passage whether the passage is from inside to out or from outside to in.
- It is the algebraic sum of the number of electric field line passages through the surface where a passage of one line through the surface from inside to outside counts as +1 passage, whereas, a passage of one line through the surface from outside counts as –1 passage.
- It is the electric field line density through the surface.
- It is the electric field line density through the surface with field line density through the surface from inside to outside counting as positive field line density, and, from outside to inside counting as negative.

Question 2 **20 points** Save

What are the units of electric flux?

- Nm^2/C
- N/C
- N
- V
- V/m

Question 3 **20 points** Save

What kind of integral is

$$\oint \vec{E} \cdot d\vec{A}$$

(the integral which appears in the defining equation for electric flux $\Phi_E = \oint \vec{E} \cdot d\vec{A}$ and in Gauss's law $\oint \vec{E} \cdot d\vec{A} = \frac{Q_{IN}}{\epsilon_o}$)?

- A line integral.

- An integral over a curve.
- An integral over a surface.
- An integral over a volume.

Question 4 **20 points** Save

The area element that appears in the integral $\oint \vec{E} \cdot \overrightarrow{\mathrm{dA}}$ is a vector. Area, as an amount of "coverage" would seem to be a scalar quantity. What is the direction of the area element $\overrightarrow{\mathrm{dA}}$?

- The direction of the area element is defined to be the direction along one edge of the area element.
- The direction is the direction in which the area is facing. For a closed surface this actually only narrows it down to two possible directions, the area element could be said to be facing inward (toward the inside region of the closed surface), and, the it could be said to be facing outward. So, to be more specific, the direction of the area element is the outward direction in which the area is facing.
- The direction of the area element is the direction of the electric field at the location of the area element.
- One does not really identify a direction of the area element, rather, one identifies the direction of the dot product $\vec{E} \cdot \overrightarrow{\mathrm{dA}}$.

Question 5 **20 points** Save

3.50 nC of charge is uniformly distributed in a solid Styrofoam ball of radius 2.00 cm centered at x = 2.00 cm on the x-axis of a Cartesian coordinate system. –1.25 nC of charge is uniformly distributed on a fiberglass spherical shell of radius 5.00 cm centered on the origin of the same coordinate system. What is the value of the electric flux through an imaginary spherical shell of radius 6.00 cm centered on the origin of the coordinate system in question.

- 2.25 nC
- 1.28×10^{-9} N/C
- 127 Nm^2/C
- None of the above.

Save Submit

Preview Assessment q32

Name: q32

Instructions:

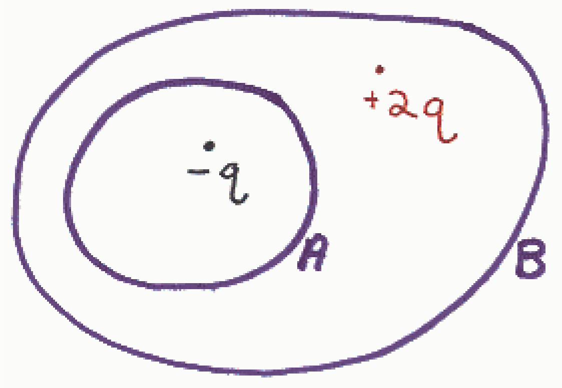
Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

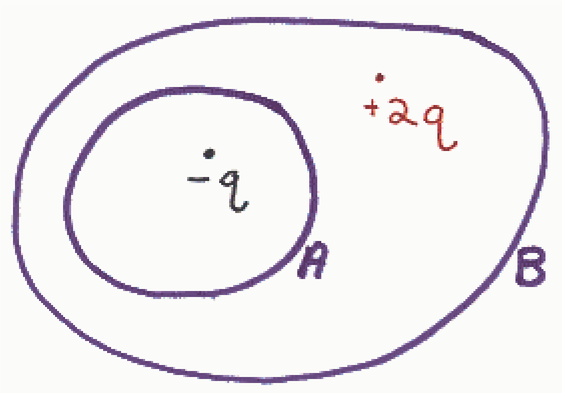
In the diagram below, the closed curves A and B represent closed surfaces. What is the total flux through the closed surface A?



- $-\dfrac{q}{\varepsilon_o}$
- $\dfrac{q}{\varepsilon_o}$
- $\dfrac{2q}{\varepsilon_o}$
- 0

Question 2 **20 points** Save

In the diagram below the closed surfaces A and B appear as closed curves. Find the flux through closed surface B.



- $-\dfrac{q}{\varepsilon_o}$
- $\dfrac{q}{\varepsilon_o}$
- $\dfrac{2q}{\varepsilon_o}$
- 0

Question 3 **20 points** Save

Gauss's Law

$$\oint \vec{E} \cdot \vec{dA} = \frac{Q_{IN}}{\epsilon_o}$$

can be considered a "cause and effect" equation. When so considered, on which side of the equation is the "cause" and on which side is the "effect?"

- The cause is on the left and the effect is on the right.
- The cause is on the right and the effect is on the left.

Question 4 **20 points** Save

Consider charge of uniform surface density (charge-per-area) everywhere on an infinite horizontal plane. In calculating the electric field due to such a charge distribution one can use a Gaussian surface in the shape of a tin can whose top is above and parallel to the plane in question and whose bottom is below and parallel to the plane. How can one tell that the electric flux through the walls of the can is zero? (If you remove the top of a can and the bottom of the can, that which is left, a piece that looks like a short length of pipe, is what we are calling the "walls" of the can.)

- At any point on the walls of the can, due to symmetry, the electric field through one side of the can will be equal but opposite to the electric field through the other side of the can, thus the two contributions to the flux cancel each other out, yield a total flux of zero.
- The can encloses no charge, hence the outward flux through the can must be zero.
- Treating each area element of the can as a vector, the net area is zero, because, for every area element on one side of the can, there is an equal area element on the other side of the can with the exact opposite direction.

- The electric field is parallel to the surface of the walls of the can, hence no electric field lines are poking through the walls of the can.

Question 5 **20 points** Save

Which of the following would be a good choice of a Gaussian surface to use to find an expression for the electric field due to an infinite line of positive charge with a uniform linear charge density.

- A can whose axis of symmetry lies on the line of charge.
- A sphere whose center lies on the line of charge.
- A cube positioned such that the line of charge passes through the centers of one pair of opposing faces.
- None of the above.

Save Submit

Preview Assessment q33

Name: q33

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

Why is it generally considered easier to determine the electric potential at a given point in space or at a given set of points in space due to a continuous charge distribution than it is to determine the electric field at the same point or set of points in space due to the same charge distribution?

- The electric potential can be determined algebraically whereas to determine the electric field, calculus is required.
- The electric potential is a scalar quantity whereas the electric field is a vector quantity.
- To determine the electric field, integral calculus is required whereas the electric potential can be determined using algebra and differentiation alone.
- None of the other answers is correct.

Question 2 **20 points** Save

Finding the electric potential due to a continuous distribution of charge involves doing an integral. An integral is an infinite sum of terms. In calculating the electric potential due to a continuous distribution of charge, what is it that one is summing? In other words, what does each term in the infinite sum represent?

- One sums the charge in the continuous distribution of charge so that one can use it in the formula $V = kQ/r$.
- One is finding the average value of the reciprocal distance between the charge distribution and the point where one is calculating the electric potential.
- Each term in the infinite sum is the electric potential, at the point at which one is calculating the electric potential, due to one infinitesimal bit of the charge in the given charge distribution.
- None of the above.

Question 3 **20 points** Save

In the case of charge distributed on a line segment, what do we mean by the expression "linear charge density λ(x)"? Note that λ(x) is to be read "lambda of x" meaning that the linear charge density is a function of x, where x is the position along the line segment in question.

- The linear charge density is the amount of charge in a meter of the line segment.
- The linear charge density is the total amount of charge on the line segment divided by the length of the line segment.
- The linear charge density is a charge packing index. Where λ is big, the charges are closely packed. Where lambda is small, the charges are sparsely packed.
- None of the above.

Question 4 **20 points** Save

Charge Q is uniformly distributed on a line segment that extends along the x-axis of a Cartesian coordinate system from the origin to x=L. (Hey, this is one of those situations in which the linear charge density is the same everywhere on the line segment, and the linear charge density is everywhere equal to the average charge density.) One is asked to find the electric potential valid for points on the positive y-axis. What should one use for the distance "r" that appears in the equation for V below (copied directly from your formula sheet)?

$$V = \frac{kq}{r}$$

- y
- $\sqrt{y^2 + L^2}$
- $\sqrt{y^2 + \left(\frac{L}{2}\right)^2}$
- The r varies with the infinitesimal element of charge under consideration. For each element of charge making up the charge distribution, the "r" is the distance from that element of charge to the point (0,y).
- None of the above.

Question 5 **20 points** Save

When one is calculating the electric potential at a particular point in space due to a continuous charge distribution, what exactly is one calculating?

- The electric-potential-energy-per-charge for the empty point in space in question.
- The electric potential energy of the charge distribution.
- The force that would be exerted on a particle having charge 1 Coulomb if that particle were at the location at which the electric potential is being calculated.
- The electric potential energy of the electron at the point in space in question.

Save Submit

Preview Assessment q34

Name: q34

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

Given the electric potential, as a function of the Cartesian coordinates x, y, and z; how does one determine the electric field?

- By means of a single integration.
- Algebraically.
- The x-component of the electric field is determined by taking the negative of the derivative of the electric potential with respect to x. The y-component of the electric field is determined by taking the negative of derivative of the electric potential with respect to y. The z-component of the electric field is determined by taking the negative of the derivative of the electric potential with respect to z.
- By taking a single derivative.

Question 2 **20 points** Save

Suppose that you are given an expression for the electric potential V(x,y) as a function of x and y valid for points in the first quadrant of a Cartesian coordinate system and asked to find the x-component of the electric field at (4.00cm,5.00cm). How do you find it?

- Take the negative of the derivative of V(x,y) with respect to x, holding y constant. Substitute x = 0.0400 m and y = 0.0500 m into the result, and evaluate.
- Substitute x = 0.0400 m and y = 0.0500 m into the given expression for the electric potential. Then take the negative of the derivative of V(x,y) with respect to x, holding y constant.
- None of the other answers are correct.

Question 3 **20 points** Save

Consider a Cartesian coordinate system on which the electric potential due to an unspecified distribution of charge is a function of x only. A graph is made of V(x) vs. x. The electric field, at a particular value of x, is what characteristic of the graph?

- The slope of the curve at the value of x in question.
- The x-intercept of the curve.
- The y-intercept of the curve.
- The area under the curve from x=0 to x equals the value of x in question.
- None of the other answers are correct.

Question 4 **20 points** Save

Is it possible for the electric field to be non-zero at a point in space where the electric potential is zero?

- Yes

No

Question 5 **20 points** Save

The x-component of the electric field characterized by an electric potential V(x,y,z) can be expressed as -dV/dx holding y and z constant. This would suggest that the units of E would be the units of V divided by the units of x, that is, in SI units, volts per meter. Are the units of E volts per meter? If not, what is wrong with the argument above?

- Yes.
- No. One cannot treat dV as if it had the same units of V and one cannot treat dx as if it had the same units of x.
- No. The units of E are N/C (newtons per coulomb).

Save Submit

Preview Assessment q35

Name: q35

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

Given the expression below valid for points in the x-y plane, what is the y-component of the electric field valid for points on the y-axis?

$$V = \frac{kQ}{L}\ln\left[\frac{L - x + \sqrt{(L-x)^2 + y^2}}{-x + \sqrt{x^2 + y^2}}\right]$$

- $-\frac{kQ}{Ly}$
- $-\frac{kQ}{L\sqrt{L^2 + y^2}}$
- $-\frac{kQ}{L^2 + y^2 + L\sqrt{L^2 + y^2}}$
- $\frac{kQ}{L}\left[\frac{1}{y} - \frac{y}{L^2 + y^2 + L\sqrt{L^2 + y^2}}\right]$

Question 2 **20 points** Save

Is it possible for the electric field to be zero in a region of space where the electric potential is not zero?

- Yes
- No

Question 3 **20 points** Save

Consider a volume of space in which the electric potential is 125,000 volts (at every point in the volume of space). What is the electric field in that region of space?

- The electric field is downward and is equal to 125,000 volts divided by the height of the volume.
- The electric field is 125,000 N/C.
- 0.
- None of the above.

Question 4 **20 points** Save

What does it mean to say that the electric potential is a function of x only. More specifically, what does the equipotential diagram (in 3-dimensional space) look like in the case of an electric potential that is a function of x only.

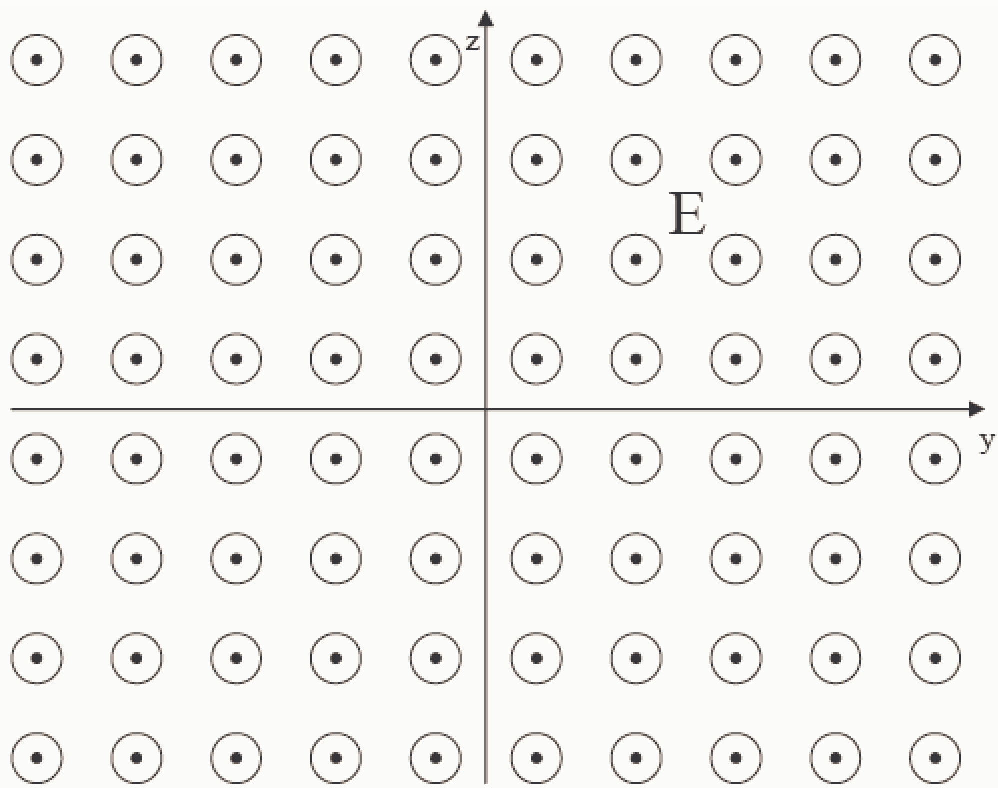
- ◯ The equipotential diagram is a set of planes parallel to the y-z plane.
- ◯ The equipotential diagram is a series of dots on the x axis.
- ◯ The equipotential diagram is a series of spheres, all centered on the origin.
- ◯ None of the above.

Question 5 **20 points** Save

Draw the electric field diagram, as viewed by a person positioned on the positive x-axis who is looking back toward the origin for the case of an electric field characterized by the electric potential:

$$V = 5.00 \frac{\text{volts}}{\text{meter}} x$$

◯



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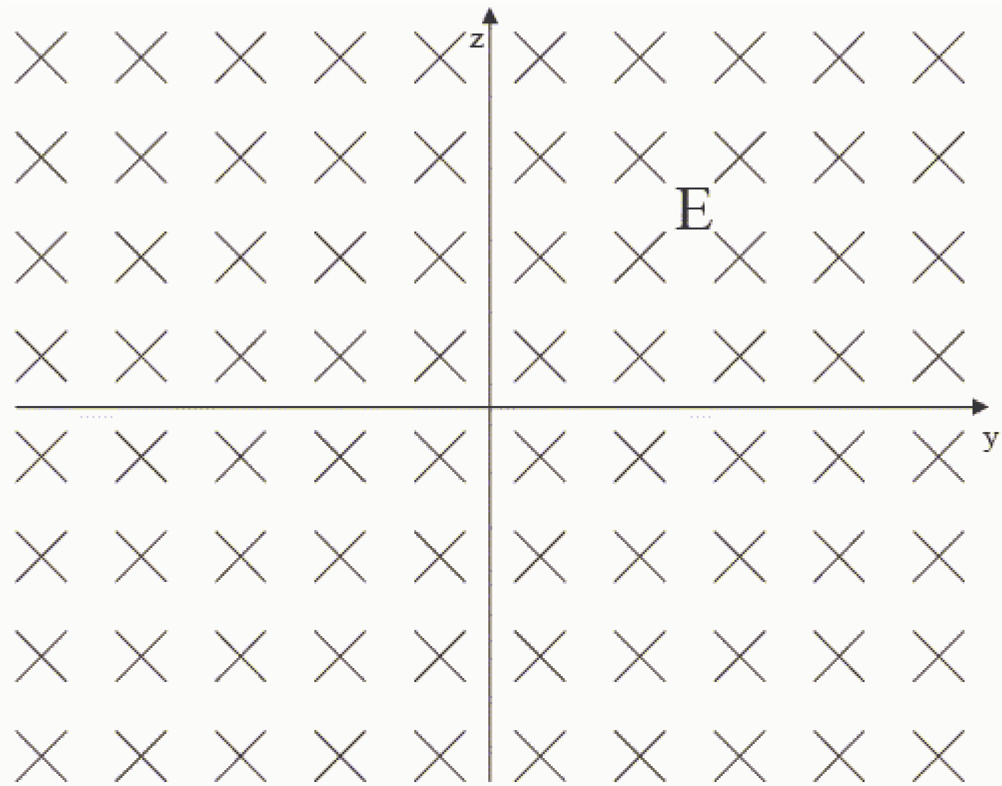
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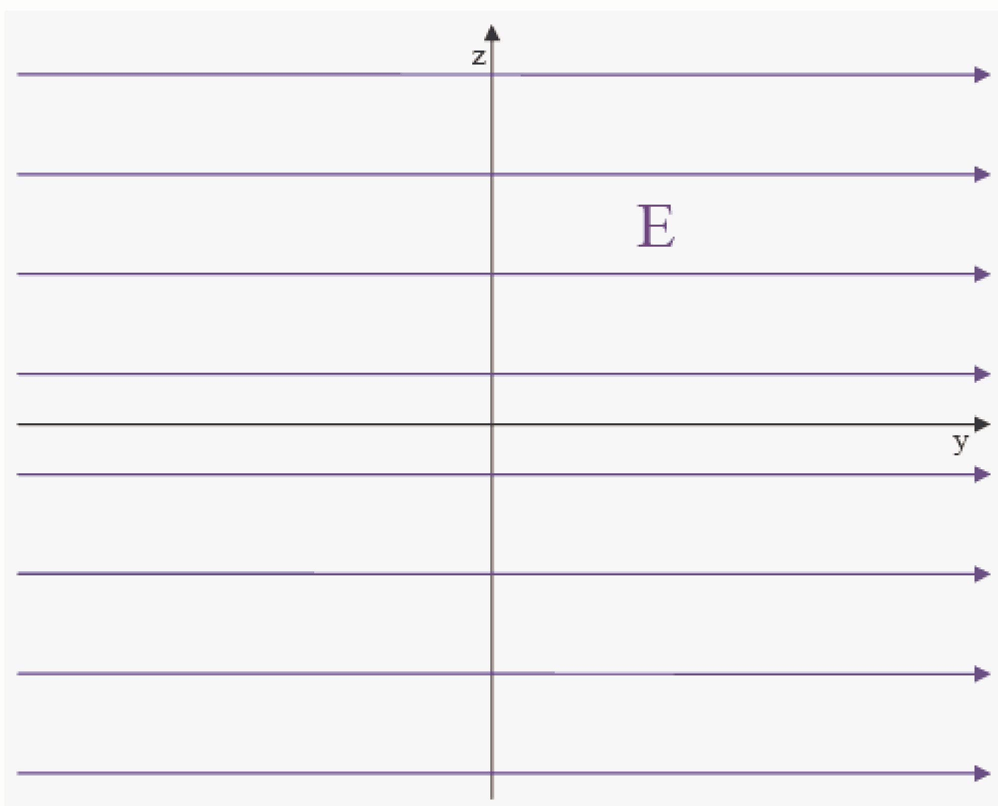
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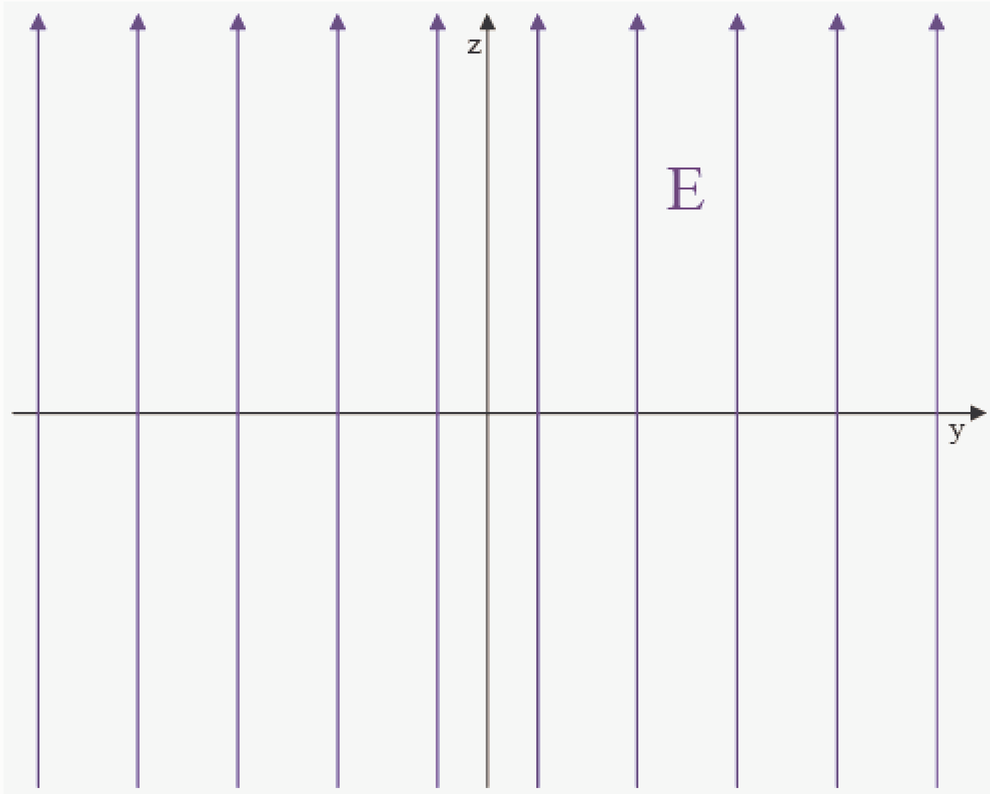

Save Submit

Preview Assessment q36

Name: q36

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

The integral in Ampere's Law (see the equation below) is an integral...

$$\oint \vec{B} \cdot d\vec{\ell} = \mu_o I$$

- along a path.
- over an area.
- throughout a volume.

Question 2 **20 points** Save

In evaluating the integral one evaluates in applying Ampere's Law one is

- evaluating an infinite sum over different points in space at which there exists a magnetic field due to a current in a wire that, in many cases, does not occupy any of these points in space.
- evaluating an infinite sum of the contributions to the magnetic field at one point in space due to each infinitesimal segment of the current-carrying conductor that is producing the magnetic field.

Question 3 **20 points** Save

Conceptually, Ampere's Law,

$$\oint \vec{B} \cdot d\vec{\ell} = \mu_o I$$

is a statement of the fact that:

- A changing magnetic field causes an electric field.
- A stationary charged particle causes a magnetic field.
- A stationary charged particle causes an electric field.
- An electric current causes a magnetic field.

Question 4 **20 points** Save

Ampere's Law is a relation between cause and effect. When Ampere's law is written in the form below, on which side of the equation is the cause, and on which side of the equation is the effect?

$$\oint \vec{B} \cdot d\vec{\ell} = \mu_o I$$

Both the cause and the effect are on the left.

- ( )
- Both the cause and the effect are on the right.
- The cause is on the left and the effect is on the right.
- The cause is on the right and the effect is on the left.

Question 5 **20 points** Save

What is an amperian loop?

- The imaginary closed loop on which the integration appearing on the left side of Ampere's Law

  $$\oint \vec{B} \cdot d\vec{\ell} = \mu_o I$$

  is carried out.
- A pure conductor with a current in it.
- A popular French tourist roadway including stops for the house in which Ampere grew up, the grammar school attended by Ampere, the lab at the Ecole Polytechnic in which Ampere spent most of his adult working hours, and a museum including much of the laboratory apparatus that Ampere designed and used.
- A copper bracelet popular in the 1860's.

Save Submit

Preview Assessment q37

Name: q37

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **20 points** Save

In evaluating the integral that one evaluates in applying the Biot-Savart Law, one is

- evaluating an infinite sum over different points in space at which there exists a magnetic field due to a current in a wire that, in many cases, does not occupy any of these points in space.
- evaluating an infinite sum of the contributions to the magnetic field at one point in space due to each infinitesimal segment of the current-carrying conductor that is producing the magnetic field.

Question 2 **20 points** Save

What does the $\vec{r}$ in the Biot-Savart Law

$$d\vec{B} = \frac{\mu_\circ I \, d\vec{\ell} \times \vec{r}}{r^3}$$

represent?

- the radius of the amperian loop used in evaluating the Biot-Savart Law. It's direction is established by means of the right-hand rule.
- a vector from the origin of the coordinate system to the geometric center of the current distribution.
- a vector whose direction is the same as the direction of the current which is causing the magnetic field and whose magnitude is the length of the current-carrying conductor.
- None of other answers are correct.

Question 3 **20 points** Sa

The r^3 in the denominator of the Biot-Savart Law:

$$d\vec{B} = \frac{\mu_\circ I \, d\vec{\ell} \times \vec{r}}{r^3}$$

suggests that the Biot-Savart Law is an inverse cube law. Is the magnetic field at some point P, due to an infinitesim
current element, indeed proportional to the reciprocal of the cube of the distance that point P is from the current elem

- Yes
- No

Question 4 **20 points** Save

What is the direction of the infinitesimal vector $d\vec{\ell}$ in the Biot-Savart Law?

- $d\vec{l}$ is in the direction of the current.
- $d\vec{l}$ is directed from the current element that is causing the magnetic field, toward the point at which the magnetic field is being calculated.
- From the origin to the current element.
- Northward.
- None of the above.

Question 5 **20 points** Save

Points O, A, and P lie in one and the same vertical plane. Point A is 4.0 cm due east of point O. Starting at point O, one can arrive at point P by going 6.0 cm due east, and from there, 3.0 cm straight upward (not northward, upward). At point A there is an infinitesimal wire segment carrying current due east. What is the direction of the infinitesimal magnetic field vector at point P produced by the current-carrying wire segment at point A?

- Northward.
- Southward.
- Eastward.
- Westward.
- Upward.
- Downward.

Save Submit

Preview Assessment q38

Name: q38

Instructions:

Multiple Attempts: This Test allows multiple attempts.

Force Completion: This Test can be saved and resumed later.

Question Completion Status:

Question 1 **60 points** Save

Match the name of the law with the corresponding characterization of the integration that is carried out when the law is applied.

- The Biot-Savart Law
- Gauss's Law
- Ampere's Law

A. One integrates all the contributions to the electric field at one point in space by all the infinitesimal bits of charge making up the charge distribution.

B. One integrates all the contributions to the electric field at one point in space by all the infinitesimal current elements making up the total current distribution.

C. For all the infinitesimal segments making up an imaginary closed curve, one integrates the dot product of the infinitesimal length of segment and the magnetic field at the location of the segment.

D. One integrates all the contributions to the magnetic field at a given point in space of the infinite set of infinitesimal current-carrying conductor segments making up the current distribution that is causing the magnetic field.

E. Over a closed surface one integrates the component of the electric field that is perpendicular to the closed surface treating outward directed electric field as positive and inward as negative.

Question 2 **20 points** Save

In calculating the electric field at a point, call it point P, in the first quadrant of a Cartesian coordinate system due to a continuous charge distribution from 0 to L on the x-axis, we must take into account the fact that each element of charge makes a vector contribution to the electric field at point P that is in a different direction than that of the vector contribution from any other charge element. The vector contributions must be added as vectors and we typically deal with this by adding the x-components of all the vector contributions to get the x-component of the total electric field at point P, then adding the y-components to get the y-component of the total electric field, and finally, putting the components together to write an expression for the total electric field.

Now suppose that we are calculating the magnetic field at point P to a wire segment that carries current along the x-axis from 0 to L. Does the fact that the contribution to the magnetic field due to each infinitesimal element of the current-carrying conductor is a vector lead to the same complications that we find in the case of the electric field due to a line segment of charge?

- Yes
- No

Question 3 **20 points** Save

Regarding cases involving the application of the Biot-Savart Law to calculate the magnetic field due to an electric current, which of the following statements about why it is relatively easy to calculate the magnetic field due to a circular current loop, at the center of that loop, is most correct?

- The $d\vec{\ell}$ and the $\vec{r}$ in the cross product $d\vec{\ell}\times\vec{r}$ are always at right angles to each other so the magnitude of the cross product is simply $r\,d\ell$, but, one still has to deal with the fact that the vector $\vec{r}$ has a different magnitude for different elements of the current loop.

- The vector $\vec{r}$ that appears in the numerator of the Biot-Savart law and the magnitude of that same vector appears in the denominator. For the case in question that vector $\vec{r}$ has the same magnitude for every current element of the circle, but, one still has to deal with the fact that because the angle between $d\vec{\ell}$ and $\vec{r}$ depends on the choice of the element of current element in the circle, the handling of the cross product $d\vec{\ell}\times\vec{r}$ is a challenge.

- For the case in question, $\vec{r}$ has the same magnitude for every current element, and, $d\vec{\ell}\times\vec{r}$ reduces to $r\,d\ell$.

- From among those cases in which one is calculating the magnetic field due to a current-carrying wire that lies in a plane, at a point in the same plane, the case at hand is actually one of the more difficult cases. For instance, the case in which one is to determine the magnetic field at a point in the first quadrant of a Cartesian coordinate system due to a piece of straight current-carrying wire that lies in the x-y plane is much easier than the case in question.

Save Submit