Course Review -- Practice Test

Due: 11:59pm on Wednesday, May 15, 2013

Note: To understand how points are awarded, read your instructor's Grading Policy.

Conceptual Question 20.03

Description: (a) When two point charges are a distance d part, the electric force that each one feels from the other has magnitude F. In order to make this force twice as strong, the distance would have to be changed to...

Part A

When two point charges are a distance d part, the electric force that each one feels from the other has magnitude F. In order to make this force twice as strong, the distance would have to be changed to

ANSWER:

- ○ d/2.
- ○ 2d.
- ◉ $d/\sqrt{2}$
- ○ $\sqrt{2}d$.
- ○ d/4.

Conceptual Question 20.05

Description: (a) A positive point charge Q is fixed on a very large horizontal frictionless tabletop. A second positive point charge q is released from rest near the stationary charge and is free to move. Which statement best describes the motion of q after it...

Part A

A positive point charge Q is fixed on a very large horizontal frictionless tabletop. A second positive point charge q is released from rest near the stationary charge and is free to move. Which statement best describes the motion of q after it is released?

ANSWER:

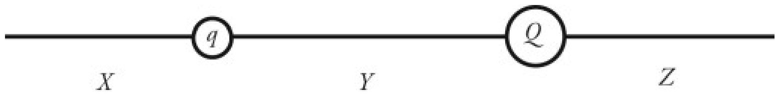
- ○ Its acceleration is zero just after it is released.
- ○ Its speed will be greatest just after it is released.
- ○ As it moves farther and farther from Q, its speed will decrease.
- ○ As it moves farther and farther from Q, its acceleration will keep increasing.
- ◉ As it moves farther and farther from Q, its speed will keep increasing.

Conceptual Question 20.07

Description: (a) The figure shows two unequal point charges, q and Q, of opposite sign. Charge Q has greater magnitude than charge q. In which of the regions X, Y, Z will there be a point at which the net electric field due to these two charges is zero?

Part A

The figure shows two unequal point charges, *q* and Q, of opposite sign. Charge *Q* has greater magnitude than charge *q*. In which of the regions *X*, *Y*, *Z* will there be a point at which the net electric field due to these two charges is zero?



ANSWER:

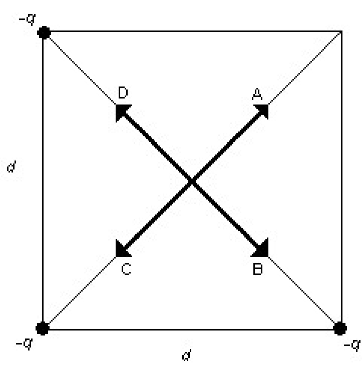
- (selected) only region *X*
- only regions *X* and *Z*
- only region *Y*
- only region *Z*
- all three regions

Conceptual Question 20.10

Description: (a) Three equal negative point charges are placed at three of the corners of a square of side d as shown in the figure. Which of the arrows represents the direction of the net electric field at the center of the square?

Part A

Three equal negative point charges are placed at three of the corners of a square of side *d* as shown in the figure. Which of the arrows represents the direction of the net electric field at the center of the square?



ANSWER:

- A
- B
- (selected) C
- D
- The field is equal to zero at point *P*.

Problem 20.01

Description: (a) A piece of plastic has a net charge of +2.00 μC. How many more protons than electrons does this piece of plastic have? (e =

1.60 × 10-19 C)...

Part A

A piece of plastic has a net charge of +2.00 μC. How many more protons than electrons does this piece of plastic have? (e = 1.60 × 10^{-19} C)

ANSWER:

- 2.50×10^{19}
- 1.25×10^{13} (selected)
- 1.25×10^{19}
- 2.50×10^{13}

Problem 20.02

Description: (a) A 1.0-C point charge is 15 m from a second point charge, and the electric force on one of them due to the other is 1.0 N. What is the magnitude of the second charge? (k=1/4pi(epsilon)_0=8.99*10^9 N · m2/C2)...

Part A

A 1.0-C point charge is 15 m from a second point charge, and the electric force on one of them due to the other is 1.0 N. What is the magnitude of the second charge? ($k = 1/4\pi\epsilon_0 = 8.99 \times 10^9$ N · m^2/C^2)

ANSWER:

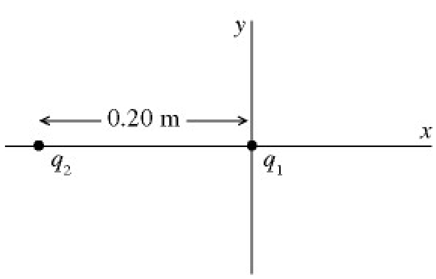
- 1.0 C
- 10 nC
- 25 nC (selected)
- 0.025 C
- 25 C

Problem 20.07

Description: (a) In the figure, charge q 1 = v1 × 10-6 C is placed at the origin and charge q 2 = -v10 × 10-6 C is placed on the x-axis, at x = -0.20 m. Where along the positive x-axis can a third charge Q = -8.3 μC be placed such that the resultant...

Part A

In the figure, charge $q_1 = 3 \times 10^{-6}$ C is placed at the origin and charge $q_2 = -5.4 \times 10^{-6}$ C is placed on the x-axis, at x = -0.20 m. Where along the positive x-axis can a third charge Q = -8.3 μC be placed such that the resultant force on this third charge is zero?



Express your answer using two significant figures.

ANSWER:

x = $v11$ = 0.59 m

Problem 20.23

Description: (a) Two point charges of +v1 μC and -v2 μC are separated by a distance of 20.0 cm. What is the magnitude of electric field due to these charges at a point midway between them? (k = 1/4πε = 8.99 × 109 N · m2/C2)...

Part A

Two point charges of +60.0 μC and -12.0 μC are separated by a distance of 20.0 cm. What is the magnitude of electric field due to these charges at a point midway between them? ($k = 1/4\pi\varepsilon_0 = 8.99 \times 10^9$ N · m^2/C^2)

ANSWER:

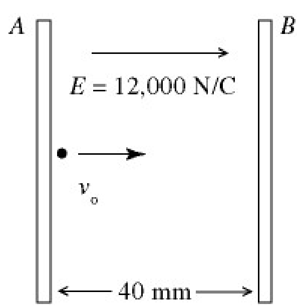
- (selected) 64.7×10^6 N/C directed toward the negative charge
- 64.7×10^5 N/C directed toward the negative charge
- 64.7×10^4 N/C directed toward the negative charge
- 64.7×10^6 N/C directed toward the positive charge
- 64.7×10^5 N/C directed toward the positive charge

Problem 20.34

Description: (a) A pair of charged conducting plates produces a uniform field of 12,000 N/C, directed to the right, between the plates. The separation of the plates is 40 mm. An electron is projected from plate A, directly toward plate B, with an initial...

Part A

A pair of charged conducting plates produces a uniform field of $12,000$ N/C, directed to the right, between the plates. The separation of the plates is 40 mm. An electron is projected from plate A, directly toward plate B, with an initial velocity of $v_0 = 2.0 \times 10^7$ m/s, as shown in the figure. ($e = 1.60 \times 10^{-19}$C, $\epsilon_0 = 8.85 \times 10^{-12}$ C^2/N · m^2, $m_{el} = 9.11 \times 10^{-31}$ kg) The velocity of the electron as it strikes plate B is closest to



ANSWER:

- 2.1×10^7 m/s.
- (selected) 1.5×10^7 m/s.
- 2.4×10^7 m/s.
- 1.8×10^7 m/s.
- 1.2×10^7 m/s.

Conceptual Question 22.15

Description: (a) A negative charge is moved from point A to point B along an equipotential surface. Which of the following statements must be true for this case?

Part A

A negative charge is moved from point A to point B along an equipotential surface. Which of the following statements must be true for this case?

ANSWER:

- Work is done in moving the negative charge from point A to point B.
- Work is required to move the negative charge from point A to point B.
- The negative charge performs work in moving from point A to point B.
- The work done on the charge depends on the distance between A and B.
- (selected) No work is required to move the negative charge from point A to point B.

Conceptual Question 22.03

Description: (a) If the electrical potential in a region is constant, the electric field must be zero everywhere in that region.

Part A

If the electrical potential in a region is constant, the electric field must be zero everywhere in that region.

ANSWER:

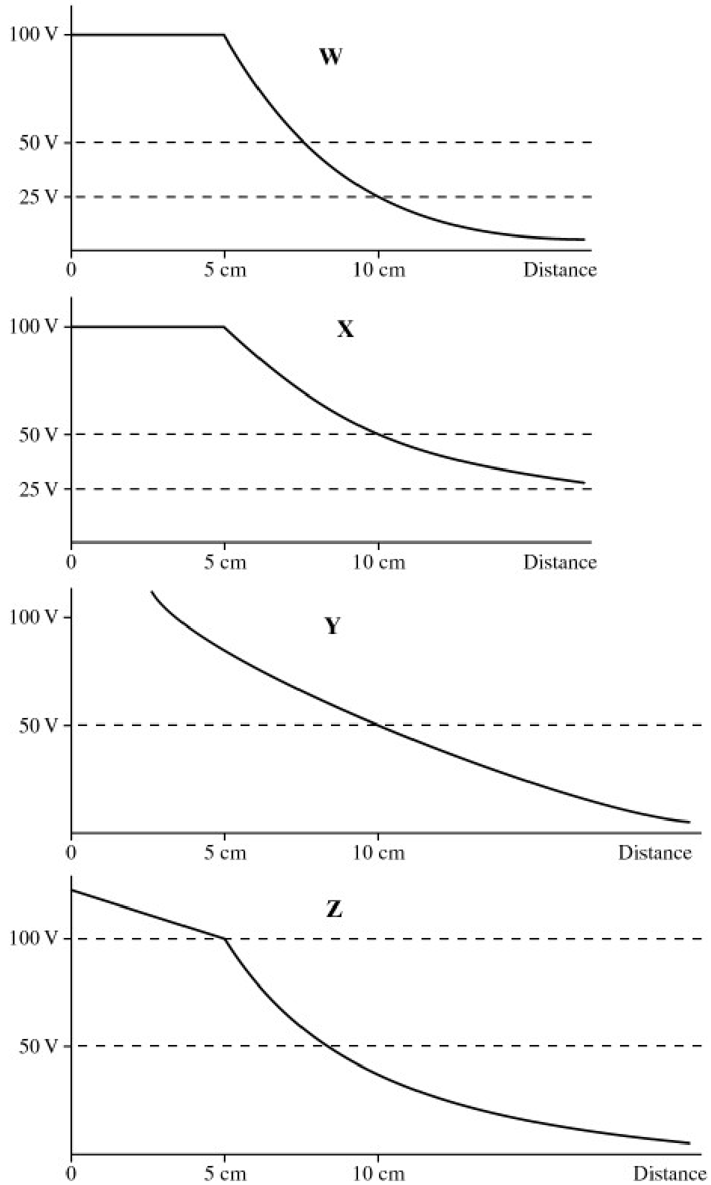
- (selected) True
- False

Conceptual Question 22.11

Description: (a) A metallic sphere of radius 5 cm is charged such that the potential of its surface is 100 V (relative to infinity). Which of the following plots correctly shows the potential as a function of distance from the center of the sphere?

Part A

A metallic sphere of radius 5 cm is charged such that the potential of its surface is 100 V (relative to infinity). Which of the following plots correctly shows the potential as a function of distance from the center of the sphere?



ANSWER:

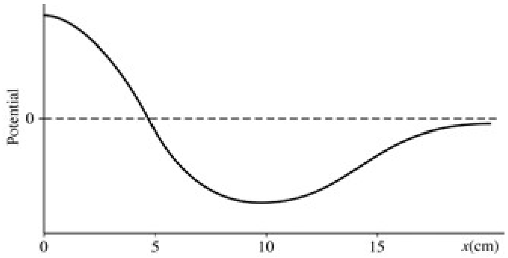
- plot W
- plot X (selected)
- plot Y
- plot Z

Conceptual Question 22.18

Description: (a) The potential as a function of position x is shown in the graph in the figure. Which statement about the electric field is true?

Part A

The potential as a function of position x is shown in the graph in the figure. Which statement about the electric field is true?



ANSWER:

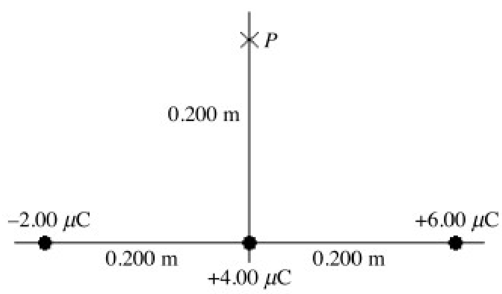
- The electric field is zero at *x* = 10 cm, its magnitude is at a maximum at *x* = 5 cm, and the field is directed to the left there.
- The electric field is zero at *x* = 0, its magnitude is at a maximum at *x* = 15 cm, and the field is directed to the left there.
- (selected) The electric field is zero at *x* = 0, its magnitude is at a maximum at *x* = 5 cm, and the field is directed to the right there.
- The electric field is zero at *x* = 5 cm, its magnitude is at a maximum at *x* = 0, and the field is directed to the right there.

Problem 22.02

Description: (a) Three point charges of -2.00 μC, +4.00 μC, and +6.00 μC are placed along the x-axis as shown in the figure. What is the electrical potential at point P (relative to infinity) due to these charges? (k = 1/4π varepsilon_0= 8.99 × 109 N · m2/C2)...

Part A

Three point charges of -2.00 μC, +4.00 μC, and +6.00 μC are placed along the x-axis as shown in the figure. What is the electrical potential at point P (relative to infinity) due to these charges? (k = 1/4π ε_0= 8.99 × 10^9 N · m^2/C^2)



ANSWER:

- +154 kV
- (selected) +307 kV
- -307 kV
- -154 kV
- 0 kV

Problem 22.14

Description: (a) If an electron is accelerated from rest through a potential difference of 9.9 kV, what is its resulting speed? (e = 1.60 × 10-19 C, k = 1/4πvarepsilon_0 = 8.99 × 109 N · m2/C2, m el = 9.11 x 10-31 kg)...

Part A

If an electron is accelerated from rest through a potential difference of 9.9 kV, what is its resulting speed? (e = 1.60 × 10^{-19} C, k = 1/4$\pi\varepsilon_0$ = 8.99 × 10^9 N · m^2/C^2, m_{el} = 9.11 x 10^{-31} kg)

ANSWER:

- ◉ 5.9×10^7 m/s
- ○ 2.9×10^7 m/s
- ○ 3.9×10^7 m/s
- ○ 4.9×10^7 m/s

Problem 22.37

Description: (a) In a certain region, the electric potential due to a charge distribution is given by the equation V(x,y) = 2xy - x^2 - y, where x and y are measured in meters and V is in volts. At which point is the electric field equal to zero?

Part A

In a certain region, the electric potential due to a charge distribution is given by the equation $V(x,y) = 2xy - x^2 - y$, where *x* and *y* are measured in meters and V is in volts. At which point is the electric field equal to zero?

ANSWER:

- ○ x = 0.5 m, y = 1 m
- ○ x = 1 m, y = 0.5 m
- ○ x = 1 m, y = 1 m
- ◉ x = 0.5 m, y = 0.5 m
- ○ x = 0 m, y = 0 m

Conceptual Question 23.08

Description: (a) An ideal parallel-plate capacitor consists of a set of two parallel plates of area A separated by a very small distance d. When this capacitor is connected to a battery that maintains a constant potential difference between the plates, the...

Part A

An ideal parallel-plate capacitor consists of a set of two parallel plates of area A separated by a very small distance d. When this capacitor is connected to a battery that maintains a constant potential difference between the plates, the energy stored in the capacitor is U_0. If the separation between the plates is doubled, how much energy is stored in the capacitor?

ANSWER:

- ◉ $U_0/2$
- ○ U_0
- ○ $4U_0$
- ○ $U_0/4$
- ○ $2U_0$

Conceptual Question 23.12

Description: (a) An ideal air-filled parallel-plate capacitor has round plates and carries a fixed amount of equal but opposite charge on its plates. All the geometric parameters of the capacitor (plate diameter and plate separation) are now DOUBLED. If the...

Part A

An ideal air-filled parallel-plate capacitor has round plates and carries a fixed amount of equal but opposite charge on its plates. All the geometric parameters of the capacitor (plate diameter and plate separation) are now DOUBLED. If the original energy density between the plates was u_0, what is the new energy density?

ANSWER:

- u_0
- $4u_0$
- (selected) $u_0/16$
- $16u_0$
- $u_0/4$

Problem 23.18

Description: (a) A 1.0-μF and a 2.0-μF capacitor are connected in series across a 3.0-V voltage source.(a) What is the charge on the 1.0-μF capacitor? (b) (b) What is the voltage across the 2.0-μF capacitor?

Part A

A 1.0-*μ*F and a 2.0-μF capacitor are connected in series across a 3.0-V voltage source.
(a) What is the charge on the 1.0-*μ*F capacitor?

ANSWER:

2.00 μC

Part B

(b) What is the voltage across the 2.0-*μ*F capacitor?

ANSWER:

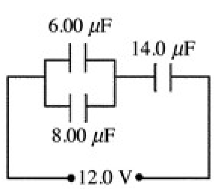
1.00 V

Problem 23.21

Description: (a) Two capacitors of capacitance 6.00 μF and 8.00 μF are connected in parallel. The combination is then connected in series with a 12.0-V voltage source and a 14.0-μF capacitor, as shown in the figure. (a) What is the equivalent capacitance of...

Part A

Two capacitors of capacitance 6.00 *μ*F and 8.00 μF are connected in parallel. The combination is then connected in series with a 12.0-V voltage source and a 14.0-*μ*F capacitor, as shown in the figure.



(a) What is the equivalent capacitance of this combination?

ANSWER:

7.00 μF

Part B

(b) What is the charge on the 6.00-μF capacitor?

ANSWER:

36.0 μC

Part C

(c) What is the potential difference across the 6.00-μF capacitor?

ANSWER:

6.00 V

Problem 23.24

Description: (a) A C-μF parallel-plate capacitor has charges of q μC on its plates. How much potential energy is stored in this capacitor?

Part A

A 4.00-μF parallel-plate capacitor has charges of 20.0 μC on its plates. How much potential energy is stored in this capacitor?

ANSWER:

- 20.0 μJ
- (selected) 50.0 μJ
- 30.0 μJ
- 60.0 μJ
- 40.0 μJ

Problem 23.29

Description: (a) Each plate of an air-filled parallel-plate air capacitor has an area of 0.0040 m2, and the separation of the plates is 0.080 mm. An electric field of 5.3 × 106 V/m is present between the plates. What is the energy density between the plates?...

Part A

Each plate of an air-filled parallel-plate air capacitor has an area of 0.0040 m^2, and the separation of the plates is 0.080 mm. An electric field of 5.3×10^6 V/m is present between the plates. What is the energy density between the plates? ($\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/N \cdot m^2$)

ANSWER:

- 250 J/m^3
- (selected) 124 J/m^3
- 84 J/m^3
- 170 J/m^3
- 210 J/m^3

Conceptual Question 24.06

Description: (a) You are given a copper bar of dimensions 3 cm × 5 cm × 8 cm and asked to attach leads to it in order to make a resistor. (a) If you want to achieve the SMALLEST possible resistance, you should attach the leads to the opposite faces that…

Part A

You are given a copper bar of dimensions 3 cm × 5 cm × 8 cm and asked to attach leads to it in order to make a resistor.
(a) If you want to achieve the SMALLEST possible resistance, you should attach the leads to the opposite faces that measure

ANSWER:

- (selected) 5 cm × 8 cm.
- 3 cm × 8 cm.
- 3 cm × 5 cm.
- Any pair of faces produces the same resistance.

Part B

(b) If you want to achieve the LARGEST possible resistance, you should attach the leads to the opposite faces that measure

ANSWER:

- 5 cm × 8 cm.
- 3 cm × 8 cm.
- (selected) 3 cm × 5 cm.
- Any pair of faces produces the same resistance.

Conceptual Question 24.08

Description: (a) As current flows through a uniform wire, the wire gets hotter because the electrons stop moving and therefore transform their lost kinetic energy into thermal energy in the wire.

Part A

As current flows through a uniform wire, the wire gets hotter because the electrons stop moving and therefore transform their lost kinetic energy into thermal energy in the wire.

ANSWER:

- True
- (selected) False

Conceptual Question 24.09

Description: (a) When a potential difference of 10 V is placed across a certain solid cylindrical resistor, the current through it is 2 A. If the diameter of this resistor is now tripled, the current will be…

Part A

When a potential difference of 10 V is placed across a certain solid cylindrical resistor, the current through it is 2 A. If the diameter of this resistor is now tripled, the current will be

ANSWER:

- 2/3 A.
- 3 A.
- 2 A.
- 2/9 A.
- (selected) 18 A.

Problem 24.08

Description: (a) If a current of 2.4 A is flowing in a cylindrical wire of diameter 2.0 mm, what is the average current density in this wire?

Part A

If a current of 2.4 A is flowing in a cylindrical wire of diameter 2.0 mm, what is the average current density in this wire?

ANSWER:

- (selected) 7.6×10^5 A/m^2
- 1.9×10^5 A/m^2
- 21×10^{-6} A/m^2
- 5.2×10^{-6} A/m^2
- 3.6×10^5 A/m^2

Problem 24.22

Description: (a) Nichrome wire, often used for heating elements, has resistivity of 1.0 × 10-6 Omega · m at room temperature. What length of No. 30 wire (of diameter 0.250 mm) is needed to wind a resistor that has 50 ohms at room temperature?

Part A

Nichrome wire, often used for heating elements, has resistivity of $1.0 \times 10^{-6}\ \Omega \cdot$ m at room temperature. What length of No. 30 wire (of diameter 0.250 mm) is needed to wind a resistor that has 50 ohms at room temperature?

ANSWER:

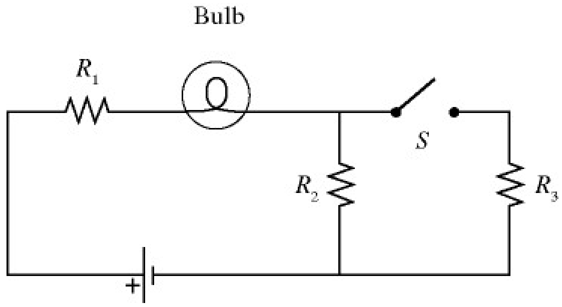
- (selected) 2.45 m
- 22.4 m
- 0.61 m
- 6.54 m
- 3.66 m

Conceptual Question 25.06

Description: (a) A light bulb is connected in the circuit shown in the figure with the switch S open. All the connecting leads have no appreciable resistance and the battery has no internal resistance. When we close the switch, which statements below accurately...

Part A

A light bulb is connected in the circuit shown in the figure with the switch S open. All the connecting leads have no appreciable resistance and the battery has no internal resistance. When we close the switch, which statements below accurately describe the behavior of the circuit? (There may be more than one correct choice.)



Choose all that apply.

ANSWER:

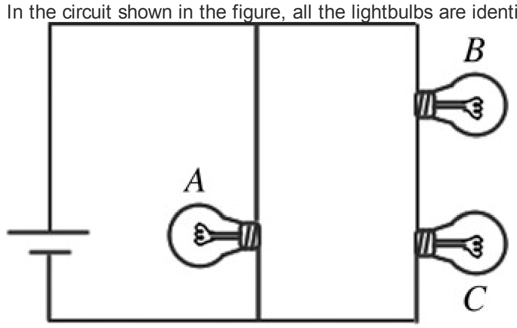
- [ ] The brightness of the bulb will decrease.
- [x] The potential drop across R 2 will decrease.
- [ ] The potential drop across R 2 will not change.
- [x] The brightness of the bulb will increase.
- [ ] The brightness of the bulb will not change.

Conceptual Question 25.03

Description: (a) In the circuit shown in the figure, all the lightbulbs are identical. Which of the following is the correct ranking of the brightness of the bulbs?

Part A

In the circuit shown in the figure, all the lightbulbs are identical. Which of the following is the correct ranking of the brightness of the bulbs?



ANSWER:

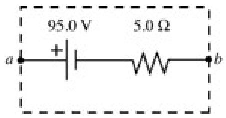
- ○ All three bulbs have the same brightness.
- ○ B and C have equal brightness, and A is the dimmest.
- ● A is the brightest, and B and C have equal brightness but less than A.
- ○ A is brightest, C is dimmest, and B is in between.
- ○ A and B have equal brightness, and C is the dimmest.

Problem 25.01

Description: (a) The emf and the internal resistance of a battery are as shown in the figure. If a current of 8.3 A is drawn from the battery when a resistor R is connected across the terminals ab of the battery, what is the power dissipated by the resistor R?

Part A

The emf and the internal resistance of a battery are as shown in the figure. If a current of 8.3 A is drawn from the battery when a resistor R is connected across the terminals *ab* of the battery, what is the power dissipated by the resistor R?



ANSWER:

- (selected) 440 W
- 620 W
- 790 W
- 530 W
- 700 W

Problem 25.06

Description: (a) A 5.0-Omega resistor and a 9.0-Omega resistor are connected in parallel. A 4.0-Omega resistor is then connected in series with this parallel combination. An ideal 6.0-V battery is then connected across the series-parallel combination of the...

Part A

A 5.0-Ω resistor and a 9.0-Ω resistor are connected in parallel. A 4.0-Ω resistor is then connected in series with this parallel combination. An ideal 6.0-V battery is then connected across the series-parallel combination of the three resistors.
(a) What is the current through the 4.0-Ω resistor?

ANSWER:

2.80 A

Part B

(b) What is the current through the 5.0-Ω resistor?

ANSWER:

1.20 A

Part C

(c) What is the current through the 9.0-Ω resistor?

ANSWER:

0.900 A

Problem 25.41

Description: (a) A C-mF capacitor is discharged through a R-kΩ resistor. How long will it take for the capacitor to lose half its initial stored energy?

Part A

A 2.0-mF capacitor is discharged through a 5.3-kΩ resistor. How long will it take for the capacitor to lose half its initial stored energy?

ANSWER:

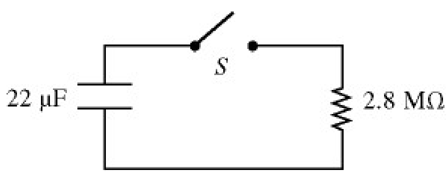
- 5.30 s
- 7.35 s
- 10.6 s
- (selected) 3.67 s
- 0.918 s

Problem 25.46

Description: (a) For the circuit shown in the figure, the switch S is initially open and the capacitor voltage is 80 V. The switch is then closed at time t = 0. How long after closing the switch will the current in the resistor be 7.0 μA?

Part A

For the circuit shown in the figure, the switch S is initially open and the capacitor voltage is 80 V. The switch is then closed at time t = 0. How long after closing the switch will the current in the resistor be 7.0 μA?



ANSWER:

- 61 s
- 95 s
- 69 s
- (selected) 87 s
- 78 s

Problem 28.02

Description: (a) Light strikes a 5.0-cm thick sheet of glass at an angle of incidence in air of 50°. The sheet has parallel faces and the glass has an index of refraction 1.50.(a) What is the angle of refraction in the glass? (b) (b) After traveling through the ...

Part A

Light strikes a 5.0-cm thick sheet of glass at an angle of incidence in air of 50°. The sheet has parallel faces and the glass has an index of refraction 1.50.
(a) What is the angle of refraction in the glass?

ANSWER:

34.0 °

Part B

(b) After traveling through the glass the light re-emerges into the air. What is the final angle of refraction in air?

ANSWER:

50.0 °

Part C

(c) As it leaves the glass, by what distance is the path of the ray is displaced from what it was before entering the glass?

ANSWER:

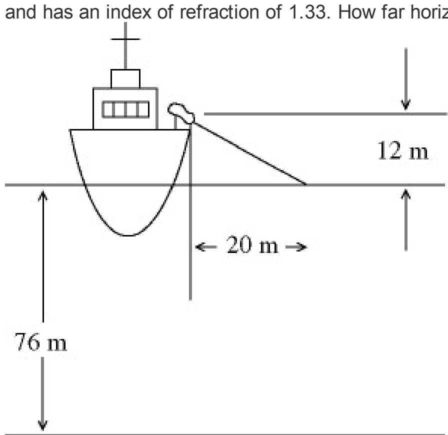
1.90 cm

Problem 28.05

Description: (a) In the figure, a laser positioned on a ship is used to communicate with a small two-man research submarine resting on the bottom of a lake. The laser is positioned 12 m above the surface of the water, and it strikes the water 20 m from the side...

Part A

In the figure, a laser positioned on a ship is used to communicate with a small two-man research submarine resting on the bottom of a lake. The laser is positioned 12 m above the surface of the water, and it strikes the water 20 m from the side of the ship. The water is 76 m deep and has an index of refraction of 1.33. How far horizontally is the submarine from the side of the ship?



ANSWER:

- 104 m
- (selected) 84.1 m
- 64.1 m
- 74.1 m
- 94.1 m

Problem 28.07

Description: (a) The speed of light in a material is v1 c. What is the critical angle of a light ray at the interface between the material and a vacuum?

Part A

The speed of light in a material is 0.56 *c*. What is the critical angle of a light ray at the interface between the material and a vacuum?

ANSWER:

- 24°
- 27°
- (selected) 34°
- 31°

Problem 28.09

Description: (a) What is the critical angle for light traveling from crown glass (n = 1.52) into water (n = 1.33)?

Part A

What is the critical angle for light traveling from crown glass (n = 1.52) into water (n = 1.33)?

ANSWER:

- ◉ 61°
- ○ 53°
- ○ 42°
- ○ 48°
- ○ 57°

Problem 32.06

Description: (a) In a double-slit experiment, the slit separation is 2.0 mm, and two wavelengths, 750 nm and 900 nm, illuminate the slits simultaneously. A screen is placed 2.0 m from the slits. At what distance from the central maximum on the screen will a...

Part A

In a double-slit experiment, the slit separation is 2.0 mm, and two wavelengths, 750 nm and 900 nm, illuminate the slits simultaneously. A screen is placed 2.0 m from the slits. At what distance from the central maximum on the screen will a bright fringe from one pattern first coincide with a bright fringe from the other?

ANSWER:

- ○ 3.0 mm
- ○ 6.0 mm
- ◉ 4.5 mm
- ○ 9.0 mm
- ○ 1.5 mm

Problem 32.03

Description: (a) In a two-slit experiment, the slit separation is d × 10-5 m. The interference pattern is recorded on a flat screen-like detector that is 2.00 m away from the slits. If the seventh bright fringe on the detector is 10.0 cm away from the central...

Part A

In a two-slit experiment, the slit separation is 3.00×10^{-5} m. The interference pattern is recorded on a flat screen-like detector that is 2.00 m away from the slits. If the seventh bright fringe on the detector is 10.0 cm away from the central fringe, what is the wavelength of the light passing through the slits?

ANSWER:

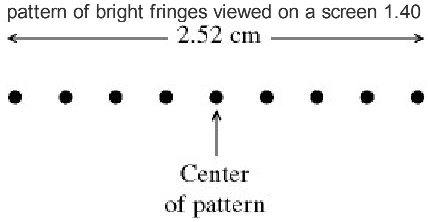
- ○ 100 nm
- ◉ 214 nm
- ○ 234 nm
- ○ 204 nm
- ○ 224 nm

Problem 32.15

Description: (a) Coherent monochromatic light of wavelength 632.8 nm passes through a pair of thin parallel slits. The figure shows the central portion of the pattern of bright fringes viewed on a screen 1.40 m beyond the slits. What is the distance between the...

Part A

Coherent monochromatic light of wavelength 632.8 nm passes through a pair of thin parallel slits. The figure shows the central portion of the pattern of bright fringes viewed on a screen 1.40 m beyond the slits. What is the distance between the two slits?



ANSWER:

- (selected) 0.281 mm
- 0.0703 mm
- 0.633 mm
- 0.141 mm
- 0.562 mm

Problem 32.26

Description: (a) A puddle of water has a thin film of gasoline floating on it. A beam of light is shining perpendicular on the film. If the wavelength of light incident on the film is 560 nm and the indices of refraction of gasoline and water are 1.40 and 1.33,...

Part A

A puddle of water has a thin film of gasoline floating on it. A beam of light is shining perpendicular on the film. If the wavelength of light incident on the film is 560 nm and the indices of refraction of gasoline and water are 1.40 and 1.33, respectively, what is the minimum thickness of the film to see a bright reflection?

ANSWER:

- 400 nm
- (selected) 100 nm
- 300 nm
- 200 nm
- 500 nm

Problem 32.76

Description: (a) Treat each of your eyes as a circular aperture of diameter 3.5 mm. Light of wavelength 500 nm is used to view two point sources that are 894 m distant from you. How far apart must these two point sources be if they are to be just resolved by...

Part A

Treat each of your eyes as a circular aperture of diameter 3.5 mm. Light of wavelength 500 nm is used to view two point sources that are 894 m distant from you. How far apart must these two point sources be if they are to be just resolved by your eye? Assume that the resolution is diffraction limited and use Rayleigh's criterion.

ANSWER:

16.0 cm

Problem 27.01

Description: (a) A circular loop of radius 0.10 m is rotating in a uniform external magnetic field of 0.20 T. (a) Find the magnetic flux through the loop due to the external field when the plane of the loop and the magnetic field vector are parallel. (b) (b)...

Part A

A circular loop of radius 0.10 m is rotating in a uniform external magnetic field of 0.20 T.
(a) Find the magnetic flux through the loop due to the external field when the plane of the loop and the magnetic field vector are parallel.

ANSWER:

0 $\mathrm{T \cdot m^2}$

Part B

(b) Find the magnetic flux through the loop due to the external field when the plane of the loop and the magnetic field vector are perpendicular.

ANSWER:

$6.3 \cdot 10^{-3}$ $\mathrm{T \cdot m^2}$

Part C

(c) Find the magnetic flux through the loop due to the external field when the plane of the loop and the magnetic field vector are at an angle of 30° with each other.

ANSWER:

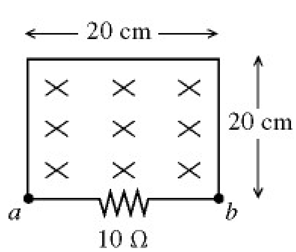
$3.1 \cdot 10^{-3}$ $\mathrm{T \cdot m^2}$

Problem 27.10

Description: (a) As shown in the figure, a wire and a 10-Ω resistor are used to form a circuit in the shape of a square, 20 cm by 20 cm. A uniform but nonsteady magnetic field is directed into the plane of the circuit. The magnitude of the magnetic field is...

Part A

As shown in the figure, a wire and a 10-Ω resistor are used to form a circuit in the shape of a square, 20 cm by 20 cm. A uniform but nonsteady magnetic field is directed into the plane of the circuit. The magnitude of the magnetic field is decreased from 2.1 T to 0.7 T in a time interval of 92 ms. The average induced current and its direction through the resistor, in this time interval, are closest to



ANSWER:

- 61 mA, from *b* to *a*. (selected)
- 91 mA, from *a* to *b*.
- 37 mA, from *b* to *a*.
- 61 mA, from *a* to *b*.
- 37 mA, from *a* to *b*.

Conceptual Question 27.04

Description: (a) A coil lies flat on a tabletop in a region where the magnetic field vector points straight up. The magnetic field vanishes suddenly. When viewed from above, what is the direction of the induced current in this coil as the field fades?

Part A

A coil lies flat on a tabletop in a region where the magnetic field vector points straight up. The magnetic field vanishes suddenly. When viewed from above, what is the direction of the induced current in this coil as the field fades?

ANSWER:

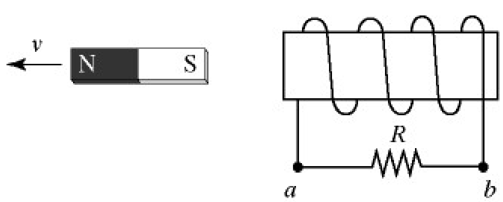
- clockwise then counter-clockwise
- clockwise
- counter-clockwise (selected)
- counter-clockwise then clockwise
- There is no current induced in the coil.

Conceptual Question 27.11

Description: (a) In the figure, a bar magnet moves away from the solenoid. The induced current through the resistor R is...

Part A

In the figure, a bar magnet moves away from the solenoid. The induced current through the resistor R is



ANSWER:

- from b to a.
- from a to b. (selected)
- There is no induced current through the resistor.

Problem 27.03

Description: (a) A 200-loop coil of cross sectional area 8.5 cm2 lies in the plane of the page. An external magnetic field of 0.060 T is directed out of the plane of the page. The external field decreases to 0.020 T in 12 milliseconds.(a) What is the magnitude...

Part A

A 200-loop coil of cross sectional area 8.5 cm^2 lies in the plane of the page. An external magnetic field of 0.060 T is directed out of the plane of the page. The external field decreases to 0.020 T in 12 milliseconds.
(a) What is the magnitude of the change in the external magnetic flux enclosed by the coil?

ANSWER:

$4.0 \cdot 10^{-3} \quad T \cdot m^2$

Part B

(b) What is the magnitude of the average voltage induced in the coil as the external flux is changing?

ANSWER:

0.570 V

Part C

(c) If the coil has a resistance of 4.0 ohms, what is the magnitude of the average current in the coil?

ANSWER:

0.140 A

Problem 27.21

Description: (a) At what rate would the current in a 100-mH inductor have to change to induce an emf of 1000 V in the inductor?

Part A

At what rate would the current in a 100-mH inductor have to change to induce an emf of 1000 V in the inductor?

ANSWER:

- 1000 A/s
- 10 A/s
- 1 A/s
- 100 A/s
- 10,000 A/s (selected)

Problem 27.29

Description: (a) A series circuit consists of a 0.55-H inductor with internal resistance of 8.0 Omega connected in series with a 4.0-Omega resistor, an open switch, and an ideal 12-V battery.(a) When the switch is closed, what is the initial current through the...

Part A

A series circuit consists of a 0.55-H inductor with internal resistance of 8.0 Ω connected in series with a 4.0-Ω resistor, an open switch, and an ideal 12-V battery.
(a) When the switch is closed, what is the initial current through the 4.0-Ω resistor?

ANSWER:

0 A

Part B

(b) What is the current through the 4.0-Ω resistor a very long time after the switch is closed?

ANSWER:

1.00 A

Problem 27.32

Description: (a) What resistance should be added in series with a v1-H inductor to complete an LR circuit with a time constant of v2 ms?

Part A

What resistance should be added in series with a 5.0-H inductor to complete an *LR* circuit with a time constant of 5.0 ms?

ANSWER:

- (selected) 1.0 kΩ
- 1.0 Ω
- 3.2 Ω
- 25 Ω