Q1.



A sinusoidal wave traveling on a string in the negative x direction has an amplitude of

0.10 m, a wavelength of 0.1 m and a frequency of 20 Hz. A particle at x = 0 and t = 0 has a displacement of +0.10 m. Choose the correct equation of the displacement of the particles as a function of x and t, where x is in meter and t in second.

A) y (x,t) = (0.10 m) sin(20πx+40πt+π/2)

B) y (x,t) = (0.10 m) sin(20πx+40πt)

C) y (x,t) = (0.10 m) sin(20πx − 40πt)

D) y (x,t) = (0.10 m) sin(40πx+20πt + π/2)

E) y (x,t) = (0.10 m) sin(20πx − 40πt + π/2)

Sec# Wave - I - Wavelength and Frequency

Grade# 56

Q2.

A tube open at one end has a length of 50 cm. Calculate the speed of sound in air if the fifth harmonic in this tube is 850 Hz.

A) 340 m/s

B) 348 m/s

C) 343 m/s

D) 338 m/s

E) 345 m/s

Sec# Wave - II - Source of Musical Sound

Grade# 44

Q3.

How much mass of aluminum initially at 150 0C must be added to 500 g of water, in a container, initially at 20.0 0C to make the final equilibrium temperature 50.0 0C? (neglect the heat capacity of the container) Specific heat of aluminum = 0.215 cal/g0C and specific heat of water = 1.00 cal/g0C.

A) 700 g

B) 500 g

C) 833 g

D) 150 g

E) 950 g

Sec# Temerature, Heat, and the First Law of Thermodynamics - The Absorption of Heat by Solids and Liquids

Grade# 58

Q4.

An ideal monatomic gas (γ = 1.67) occupies a volume of 4.3 L at a pressure of 1.2 atm. It is compressed adiabatically to a volume of 2.1 L. Determine the final pressure of the gas.

A) 4.0 atm

B) 2.3 atm

C) 0.36 atm

D) 6.9 atm

E) 1.1 atm

Sec# The kinetic Theory of Gases - The Adiabatic Expansion of an Ideal Gas

Grade# 57

Q5.

When the temperature of a metal sphere is raised by 75 C0, the sphere’s volume increases by 6.9×10 − 5 m3. If the original volume is 1.8×10 − 2 m3, find the coefficient of linear expansion of the metal.

A) 1.7×10 − 5 / C0

B) 2.5×10 − 5 / C0

C) 5.1×10 − 5 / C0

D) 0.87×10 − 5 / C0

E) 0.45×10 − 5 / C0

Sec# Temerature, Heat, and the First Law of Thermodynamics - Thermal Expansion

Grade# 57

Q6.

You mix two samples of water, A and B. Sample A is 0.100 kg at 293 K and sample B is also 0.100 kg but at 353 K. Calculate the change in entropy of sample B.

A) −37.2 J/K

B) +37.2 J/K

C) −197 J/K

D) +197 J/K

E) Zero

Sec# Entropy and the Second Law of Thermodynamics - Change in Entropy

Grade# 46

Q7.

A charged particle, labeled A, is located at the midpoint between two other charged particles, labeled B and C, as shown in Figure 1. The sign of the charges on all three particles is the same. When particle A is released, it starts moving toward B. What can be concluded from this behavior?

Fig#

A) The charge on C is greater than the charge on B.

B) The charge on B is greater than the charge on A.

C) The charge on A is greater than the charge on B.

D) The charge on B is greater than the charge on C.

E) The charge on A is greater than the charge on C.

Sec# Electric Charge - Coulomb's Law

Grade# 53

Q8.

Four charges are located at the corners of a square as shown in Figure 2. What is the direction of the net electric field at the center of the square labeled point P?

Fig#

-2q

+q

-q

P

+2q

A) Vertically down.

B) To the Left.

C) There is no direction. The electric field at P is zero.

D) To the Right.

E) Vertically up.

Sec# Electric fields - The Electric Field Due to a Point Charge

Grade# 56

Q9.

A point charge q is located at the center of a Gaussian surface in the form of a cube. The electric flux through one face of the cube is:

A) q/6ε0

B) q/3ε 0

C) 6q/ε 0

D) 3q/ε 0

E) q/ε 0

Sec# Gauss's law - Gauss's Law

Grade# 54

Q10.

A conducting spherical shell of radius 5.0 cm carries a charge of 7.0 × 10− 8 C. What is the electric potential at the center of the sphere? Take the potential at infinity to be zero.

A) + 1.3 × 104 V

B) – 1.3 × 104 V

C) + 7.0 × 104 V

D) – 7.0 × 104 V

E) Zero

Sec# Electric Potential - Potential of a Charged Isolated Conductor

Grade# 54

Q11.

Figure 3 shows four pairs of large parallel conducting plates with the same separation. The value of the electric potential is given for each plate. The electric field between the plates is uniform and perpendicular to the plates. Rank the pairs according to the magnitude of the electric field between the plates, **least to greatest**.

Fig#



A) 2, 4, 1, 3

B) 1, 2, 3, 4

C) 2, 3, 1, 4

D) 3, 2, 4, 1

E) 2, 1, 4, 3

Sec# Electric Potential - calculating the Field from the Potential

Grade# 53

Q12.

Capacitor C1 is connected to a battery and charged until the magnitude of the charge on each plate is 10 nC. Then, it is removed from the battery and connected to two other capacitors C2 and C3, as shown in Figure 4. The charge on capacitor C1 is then 4.0 nC. The charges on capacitors C2 and C3 are:

Fig#



A) q2 = 6.0 nC and q3 = 6.0 nC

B) q2 = 10 nC and q3 = 10 nC

C) q2 = 14 nC and q3 = 14 nC

D) q2 = 20 nC and q3 = 20 nC

E) q2 = 4.0 nC and q3 = 4.0 nC

Sec# Capacitance - Capacitors in Parallel and in Series

Grade# 55

Q13.

A 100-W and a 60-W light bulbs are designed for use with the same voltage. What is the ratio of the resistance of the 100-W bulb to the resistance of the 60-W bulb?

A) 0.60

B) 1.7

C) 0.40

D) 2.5

E) 1.0

Sec# Current and Resistance - Power in Electric Circuits

Grade# 60

Q14.

If the terminals of an ideal battery are connected across two identical resistors connected in series, the total power delivered by the battery is 8.0 W. If the same battery is connected to the same two resistors which are now connected in parallel, what is the total power delivered by the battery?

A) 32 W

B) 16 W

C) 8.0 W

D) 4.0 W

E) 2.0 W

Sec# Circuits - Multiloop Circuits

Grade# 54

Q15.

In Figure 5, I2 = 0.30 A, R1 = 5.0 Ω and R2 = 8.0 Ω. Calculate the potential difference

VA – VB.

Fig#

A

B

I2

R2

R2

R1

A) 5.4 V

B) 3.9 V

C) 2.4 V

D) 1.5 V

E) 6.5 V

Sec# Circuits - Multiloop Circuits

Grade# 45

Q16.

An un-charged 5.0 µF capacitor and a 1.0 MΩ resistor are connected in series to a battery. At what time, after the battery is connected, is the potential difference across the capacitor 60% of the value of the potential difference across the battery?

A) 4.6 s

B) 3.0 s

C) 2.4 s

D) 7.2 s

E) 1.9 s

Sec# Circuits - RC Circuits

Grade# 45

Q17.

Find the value of the emf (E) of the battery shown in Figure 6, if the current I= 1.2 A.

Fig#



A) 1.8 V

B) 7.5 V

C) 3.8 V

D) 3.2 V

E) 4.3 V

Sec# Circuits - Multiloop Circuits

Grade# 48

Q18.

In the circuit shown in Figure 7, what should be the ratio E3/E1 if E1 = E2 and the electric current in the circuit equal to zero?

Fig#



A) 2.0

B) 0.50

C) 1.0

D) 4.0

E) 0.25

Sec# Circuits - Calculating the Current in a Single-Loop nCircuit

Grade# 50

Q19.

A wire bent into a semicircle of radius R forms a closed loop and carries a current I, as shown in Figure 8. The wire lies in the xy plane, and a uniform magnetic field is directed along the positive y axis. What is the magnetic force on the curved portion of the wire?

Fig#

Y

x

**B**

**I**

**I**

**R**

A) – 2IRB



B) + 2IRB



C) – πIRB



D) + πIRB



E) zero

Sec# Magnetic Fields - Magnetic Force on a Current-Carrying Wire

Grade# 50

Q20.

A proton moves with a velocity of 1.0×107 m/s in the positive z direction in a uniform magnetic field of magnitude 21×10 −3 T in the negative y direction. Determine the acceleration (in m/s2) of the proton.

A) 2.0 × 1013 in the positive x direction

B) 2.0 × 1013 in the negative x direction

C) 3.3 × 1013  in the positive x direction

D) 3.3 × 1013  in the negative x direction

E) 5.0 × 1013 in the positive x direction

Sec# Magnetic Fields - Crossed Fields: Discovery of the Electron

Grade# 45

Q21.

An electron and a proton are travelling in the same direction with the same speed. They are injected into a uniform magnetic field with their velocities perpendicular to the field. Once, they are in the field, which of the following statements is CORRECT?

A) They will experience the same magnitude of force.

B) They will have the same radius of revolution.

C) They will have the same period of revolution.

D) They will travel in the same direction.

E) They will travel with different speeds.

Sec# Magnetic Fields - A Circulating Charged Particle

Grade# 48

Q22.

A current of 15 mA is maintained in a 50-turn circular coil of radius 5.0 cm. A uniform magnetic field of magnitude 0.80 T is directed parallel to the plane of the coil. What is the magnitude of the torque exerted by the magnetic field on the coil?

A) 4.7 × 10-3 N.m

B) 1.2 × 10-4 N.m

C) 2.1 × 10-5 N.m

D) 3.1 × 10-2 N.m

E) zero

Sec# Magnetic Fields - Torque on a Current Loop

Grade# 54

Q23.

In Figure 9, an electron moves at a constant speed of 230 m/s along an *x* axis through uniform magnetic and electric fields undeflected. The magnetic field is directed into the page and has a magnitude of 5.0 mT. What is the electric field (in units of V/m)?

Fig#

Y

x

**B**

**B**

-e

A) – 1.2



B) + 1.2



C) – 2.7



D) + 2.7



E) + 4.6



Sec# Magnetic Fields - Crossed Fields: Discovery of the Electron

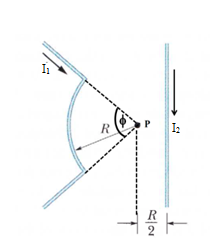
Grade# 48

Q24.

Figure 10 shows two wires each carrying a current in the direction indicated in the figure. Wire 1, which consists of a circular arc of radius R and two radial lengths, carries a current

I1= 1.5 A. Wire 2 is long and straight; carries a current I2= 0.4 A and is at a distance R/2 from the center of the arc. For what value of arc angle φ the net magnetic field B at point P due to the two currents is zero?

Fig#



A) 610

B) 550

C) 750

D) 700

E) 510

Sec# Magnetic Fields Due to Currents - Calculating the Magnetic Field Due to a Current

Grade# 50

Q25.

Three long straight wires are perpendicular to the page. Each wire carries a current of 15 A and are arranged at the three corners of a square of edge length *a* = 1.0 cm, as shown in

Figure 11. Find the magnitude of net magnetic force per unit length (in N/m) on wire 2 due to wires 1 and 3.

Fig#

y

x

a

a

1

2

3

A) 6.4 ×10-3

B) 4.6 ×10-3

C) 3.4 ×10-2

D) 4.3 ×10-2

E) 5.1 ×10-3

Sec# Magnetic Fields Due to Currents - Force Between Two Parallel Currents

Grade# 52

Q26.

A long, straight wire carries a 3.0 A current. This current creates a magnetic field of strength 1.0 T at the surface of the wire. If the wire has a radius R, where within the wire is the magnetic field strength 0.36 T? (Assume the current density is uniform throughout the wire)

A) 0.36 R

B) 0.18 R

C) 0.64 R

D) 0.72 R

E) 0.26 R

Sec# Magnetic Fields Due to Currents - Ampere’s Law

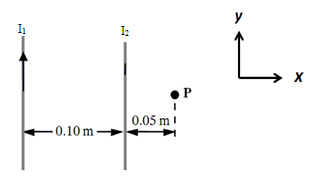
Grade# 52

Q27.

Two long, straight wires, separated by 0.10 m, carry currents I1 and I2 as shown in

Figure 12. If current I1=18 A and the resultant magnetic field due to these two current carrying wires at pointP is zero, then the magnitude and direction of I**2** is:

Fig#



A) 6.0 A, along the negative y-axis

B) 6.0 A, along the positive y-axis

C) 54 A, along the negative y-axis

D) 54 A, along the positive y-axis

E) 9.0 A, along the positive y-axis

Sec# Magnetic Fields Due to Currents - Calculating the Magnetic Field Due to a Current

Grade# 54

Q28.

A 10 m long conductor is formed into a single circular loop in the *xy*-plane. A uniform magnetic field, T, exists in the region of the conductor. Find the magnetic flux through the loop?

A) 191 T ∙ m2

B) 609 T ∙ m2

C) 152 T ∙ m2

D) 253 T ∙ m2

E) 334 T ∙ m2

Sec# Induction and Inductance - Faraday's Law of Induction

Grade# 52

Q29.

A conducting loop has an area of 0.065 m2 and is positioned such that a uniform magnetic field is perpendicular to the plane of the loop. When the magnitude of the magnetic field decreases to 0.300 T in 0.087s, the average induced emf in the loop is 1.20 V. What is the initial value of the magnetic field?

A) 1.91 T

B) 0.750 T

C) 0.800 T

D) 1.20 T

E) 0.423 T

Sec# Induction and Inductance - Faraday's Law of Induction

Grade# 56

Q30.

A circuit is pulled to the right at a constant speed v = 5.0 m/s in a uniform magnetic field B as shown in Figure 13. As the circuit moves, a 1.2 mA current flows through the resistor

R= 4.0 Ω. If L= 12 cm, then magnitude and direction of the field B is:

Fig#

**R**

**L**

**I**

******

B B B B

B B B B

B B B B

B B B B

B B B

B B B B

A) 8.0 mT, directed out of the page

B) 8.0 mT, directed into the page

C) 20 mT, directed out of the page

D) 20 mT, directed into the page

E) 14 mT, directed out of the page.

Sec# Induction and Inductance - Lenz’s Law

Grade# 58

Test Expected Average = 52