Q1.

A standing wave on a string is described by: ***y (x,t) = 0.040 (sin 5π x) (cos 40 π t)***, where ***x*** and ***y*** are in meters and ***t*** is in seconds. If the length of the string is 1.0 m, what is the harmonic number of the wave?

A) 5
B) 4
C) 3
D) 2
E) 1

Ans:

$$k = 5\pi\,(m^{-1}) \Rightarrow \lambda = \frac{2\pi}{k} = \frac{2\pi}{5\pi} = 0.40\ m$$

$$\lambda_n = \frac{2L}{n} \Rightarrow n = \frac{2L}{\lambda_n} = \frac{2 \times 1.0}{0.40} = 5$$

Q2.

The sound levels of two sound sources differ by 8.2 dB. What is the ratio of the larger to the smaller intensity?

A) 6.6
B) 1.6
C) 0.15
D) 0.63
E) 0.91

Ans:

$$\beta_1 = 10.\log(I_1/I_0)$$

$$\beta_2 = 10.\log(I_2/I_0)$$

$$\beta_2 - \beta_1 = 10.\log(I_2/I_1) \Rightarrow \frac{I_2}{I_1} = (10)^{\frac{\Delta\beta}{10}}$$

$$\therefore \frac{I_2}{I_1} = (10)^{(8.2/10)} = 6.6$$

Q3.

How much water remains unfrozen after 50 kJ is transferred as heat from 250 g of liquid water initially at 0.0 ^{o}C?

A) 100 g
B) 150 g
C) 50 g
D) 200 g
E) 0

Ans:

$$Q = m_i . L_f \ \{m_i = \text{frozen mass}\}$$

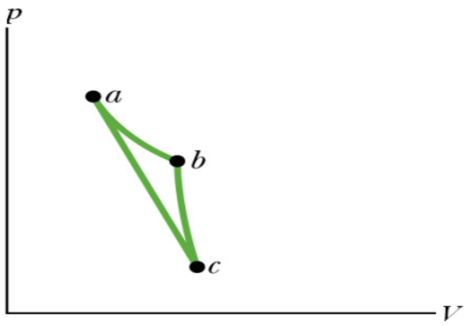
$$\Rightarrow m_i = \frac{Q}{L_f} = \frac{50}{333} = 0.15\ kg = 150\ g$$

$$\therefore \text{Remaining Liquid water} = 250 - 150 = 100\ g$$

Q4.

In the *p-V* diagram of **FIGURE 1**, the gas does 5 J of work when taken along isotherm **ab**, and 4 J of work when taken along the adiabat **bc**. What is the change in the internal energy of the gas when it is taken along the straight path from **a** to **c**?

Fig# 1



A) – 4 J
B) – 5 J
C) + 9 J
D) – 1 J
E) + 1 J

Ans:

Isotherm: $\Delta T = 0 \Rightarrow \Delta E_{int} = 0 \Rightarrow E_a = E_b$

Adiabat: $Q = 0 \Longrightarrow \Delta E_{int} = -W_{bc} = -4\ J$

$\therefore E_c - E_b = -4\ J$

Straight Path: $\Delta E_{int} = E_c - E_a = E_c - E_b = -4\ J$

Q5.

A sample of an ideal gas expands from state **A** to state **B**. Let ΔS_I denote the change in entropy of the gas for an irreversible expansion. Let ΔS_R denote the change in entropy of the gas for a reversible expansion. Then:

A) $\Delta S_I = \Delta S_R$
B) $\Delta S_I > \Delta S_R$
C) $\Delta S_I < \Delta S_R$
D) $\Delta S_I < 0$
E) $\Delta S_R < 0$

Ans:

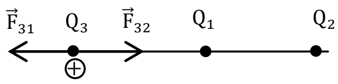
Entropy is a state function

$\Rightarrow \Delta s$ is the same along any path

Q6.

A point charge Q_1 = + 2.00 μC is placed on the *x*-axis at x = +2.00 cm. Another point charge Q_2 is placed on the *x*-axis at x = +5.00 cm. A third point charge Q_3 is placed at the origin. If the net electric force on Q_3 is zero, what is the charge Q_2?

A) – 12.5 μC
B) + 12.5 μC
C) – 5.00 μC
D) + 5.00 μC
E) – 2.00 μC



Ans:

Q_2 must be (−):

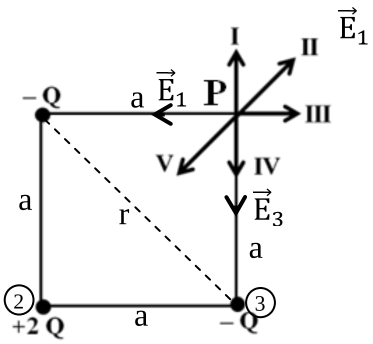
magnitude: $F_{31} = F_{32} \Rightarrow \frac{kQ_3Q_1}{4} = \frac{kQ_3Q_2}{25}$

$\Rightarrow Q_2 = \frac{25}{4} Q_1 = \frac{25}{4} \times 2 = 12.5\ \mu C$

$\Rightarrow Q_2 = -12.5\ \mu C$

Q7.

Three charged particles are fixed at the corners of a square, as shown in **FIGURE 2**. Consider point **P**, which is the top right corner of the square. Which of the indicated arrows represents the direction of the net electric field at point **P**?



A) V
B) I
C) II
D) III
E) IV

Ans:

$E_1 = E_3 = \frac{kQ}{a^2}$

$\Rightarrow E_{13} = \sqrt{2}.\frac{kQ}{a^2}$ (Southwest)

$E_2 = \frac{kQ}{r^2} = \frac{kQ}{2a^2}$ (Northeast)

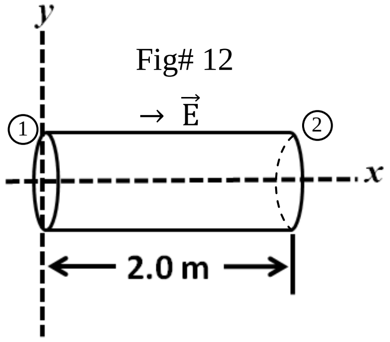
Since $E_2 < E_{13}$

$\Rightarrow E_{net}$ is southwest (i.e. V)

Q8.

A cylindrical Gaussian surface has a radius of 0.20 m. The axis of the cylinder is along the *x* axis, with one end at $x = 0$ and the other end at $x = 2.0$ m, as shown in **FIGURE 12**. The cylinder lies in a region where the electric field is $\vec{E} = x\hat{i}$ (N/C), where *x* is in meters. What is the charge enclosed inside the cylinder?

A) + 2.2 pC
B) – 4.4 pC
C) + 4.4 pC
D) – 2.2 pC
E) zero



Ans:

There is no flux through the lateral surface.

at ① : E = 0

at ② : $\vec{E} = 2\hat{i}$, $\vec{A} = (\pi r^2)\hat{i} = 0.1257\ \hat{i}\ (m^2)$

$\Rightarrow \phi_{net} = \vec{E}.\vec{A} = +0.25\ N.m^2/C$

$\phi_{net} = \frac{q_{enc}}{\varepsilon_0} \Rightarrow q_{enc} = \varepsilon_0 \cdot \phi_{net} = +2.2 \times 10^{-12}\ C$

Q9.

A uniform electric field of magnitude 350 V/m is directed in the negative *y* direction. The coordinates of point **A** are (–0.20, –0.30) m, and those of point **B** are (0.40, 0.50) m. Calculate the electric potential difference $V_B - V_A$.

A) + 280 V
B) – 280 V
C) + 210 V
D) – 210 V
E) – 350 V

Ans:

$\vec{E} = -350\ \hat{j}\ (V/m)$

$\vec{r}_A = -0.20\ \hat{i} - 0.30\ \hat{j};\ \vec{r}_B = 0.40\ \hat{i} + 0.50\ \hat{j}\ (m)$

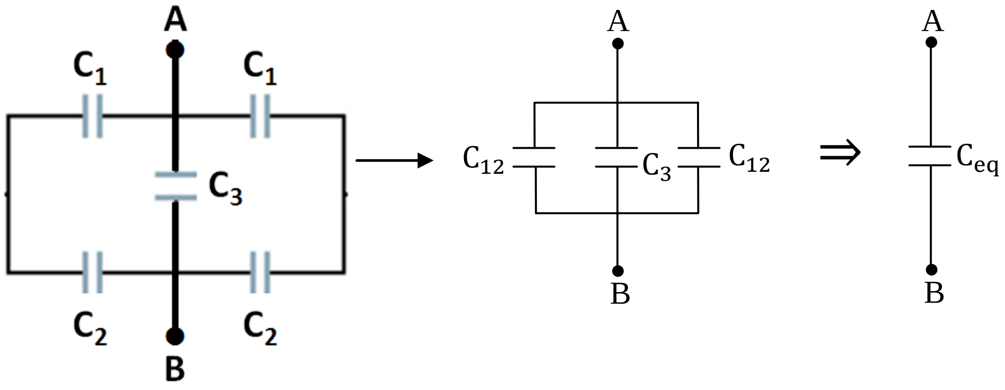
$V_B - V_A = -\vec{E}.\Delta\vec{r} = -\vec{E}.(\vec{r}_B - \vec{r}_A) = \vec{E}.(\vec{r}_A - \vec{r}_B)$

$= \left(-350\ \hat{j}\right).\left(-0.60\ \hat{i} - 0.80\ \hat{j}\right) = +280\ V$

Q10.

Consider the combination of capacitors shown in **FIGURE 3**, with C_1 = 2.0 µF, C_2 = 3.0 µF, and C_3 = 2.0 µF. What is the energy stored by the combination if the potential difference between points **A** and **B** is 60 V?

Fig# 3



A) 7.9 mJ
B) 2.0 mJ
C) 22 mJ
D) 0.83 mJ
E) 8.2 mJ

Ans:

$$C_{12} = \frac{C_1 . C_2}{C_1 + C_2} = \frac{2 \times 3}{2 + 3} = \frac{6}{5} = 1.2\ \mu F$$

$$C_{eq} = C_{12} + C_3 + C_{12} = 1.2 + 2 + 1.2 = 4.4\ \mu F$$

$$U = \frac{1}{2} C_{eq} . V^2 = \frac{1}{2} \times 4.4 \times 10^{-6} \times 3600$$

$$= 7.9 \times 10^{-3}\ J = 7.9\ m\,J$$

Q11.

A cylindrical conducting wire has radius r_i and length L_i. Its dimensions are changed to r_f and L_f. Which of the following changes results in the least resistance?

A) $r_f = 2r_i$ and $L_f = L_i/2$
B) $r_f = 2r_i$ and $L_f = 2L_i$
C) $r_f = 2r_i$ and $L_f = L_i$
D) $r_f = r_i/2$ and $L_f = L_i/2$
E) $r_f = r_i/2$ and $L_f = 2L_i$

Ans:

$$R = \frac{\rho L}{A} = \frac{\rho L}{\pi r^2}$$

$$A)\ \frac{\frac{1}{2}}{4} = \frac{1}{8}\ ;\quad B)\ \frac{2}{4} = \frac{1}{2};\quad C)\ \frac{1}{4} = \frac{1}{4}\ ;\quad D)\ \frac{\frac{1}{2}}{\frac{1}{4}} = 2\ ;\quad E)\ \frac{2}{\frac{1}{4}} = 8$$

Q12.

A light bulb utilizes a tungsten filament. The filament has a resistance of 3.40 Ω at 20.0 °C. The bulb is connected to a 24.0-V battery. When the bulb reaches its final operating temperature, the filament dissipates a power of 16.0 W. What is the operating temperature of the filament? The temperature coefficient of resistivity of tungsten is 4.50×10^{-3} K^{-1}. Assume that the dimensions of the filament do not change.

A) 2.15×10^3 °C
B) 1.44×10^3 °C
C) 2.37×10^3 °C
D) 1.90×10^3 °C
E) 2.26×10^3 °C

Ans:

$$P = \frac{V^2}{R_f} \longrightarrow R_f = \frac{V^2}{P} = \frac{(24)^2}{16} = 36\ \Omega \Rightarrow \Delta R = 32.6\ \Omega$$

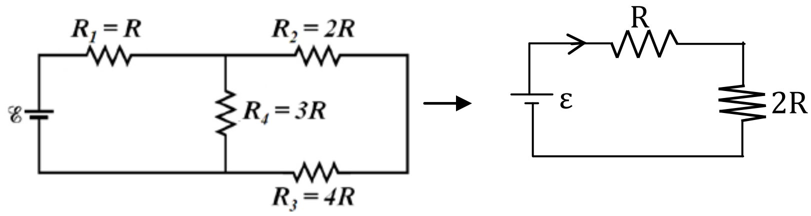
$$\Delta R = \alpha R_i\, \Delta T \Rightarrow \Delta T = \frac{\Delta R}{\alpha R_i} = \frac{32.6}{4.5 \times 10^{-3} \times 3.4} = 2131°C$$

$$\Rightarrow T_f = T_i + \Delta T = 2151°C = 2.15 \times 10^3 °C$$

Q13.

Four resistors are connected to an ideal battery, as shown in **FIGURE 13**. The current supplied by the battery is I_o. If $R_3 \to \infty$, the current supplied by the battery is

Fig# 13

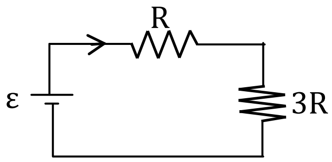


A) $\frac{3I_o}{4}$
B) $4I_o$
C) $\frac{I_o}{4}$
D) $\frac{4I_o}{3}$
E) $\frac{15I_o}{11}$

Ans:

$$I_0 = \frac{\varepsilon}{R + 2R} = \frac{\varepsilon}{3R}$$

If $R_3 \longrightarrow \infty$; the loop on the right is open:



$$\Rightarrow I_x = \frac{\varepsilon}{R + 2R} = \frac{\varepsilon}{4R}$$

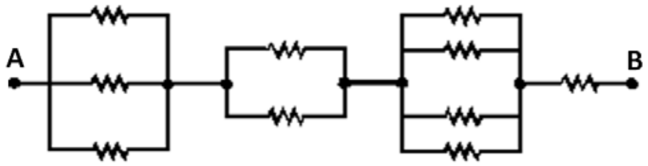
$$\Rightarrow \frac{I_x}{I_0} = \frac{\varepsilon}{4R} \cdot \frac{3R}{\varepsilon} = \frac{3}{4}$$

Q14.

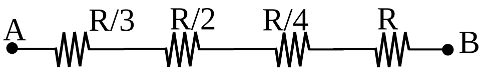
Each of the resistors in **FIGURE 4** has a resistance of 50.0 Ω. The equivalent resistance between points A and B is

Fig# 4

A) 104 Ω
B) 210 Ω
C) 171 Ω
D) 121 Ω
E) 111 Ω



Ans:



$$R_{eq} = \frac{R}{3} + \frac{R}{2} + \frac{R}{4} + R$$

$$= \frac{4R + 6R + 3R}{12} + R = \frac{13R}{12} + R$$

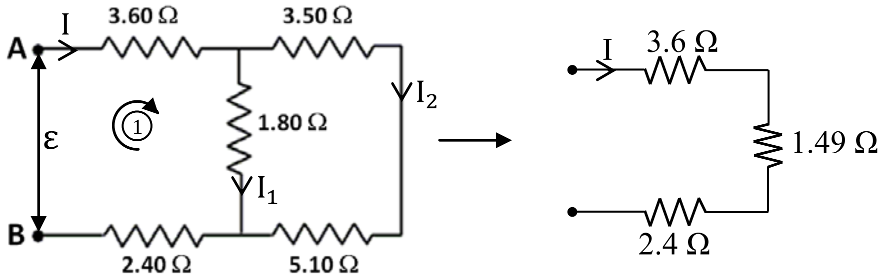
$$= \frac{25R}{12} = \frac{25}{12} \times 50 = 104\ \Omega$$

Q15.

Five resistors are connected as shown in **FIGURE 5**. The potential difference between points **A** and **B** is 25.0 V. What is current through the 1.80-Ω resistor?

Fig# 5

A) 2.76 A
B) 3.34 A
C) 1.67 A
D) 0.577 A
E) 2.09 A



Ans:

$$I = \frac{25.0}{3.60 + 2.40 + 1.49} = 3.34\ A$$

Now, consider loop 1:

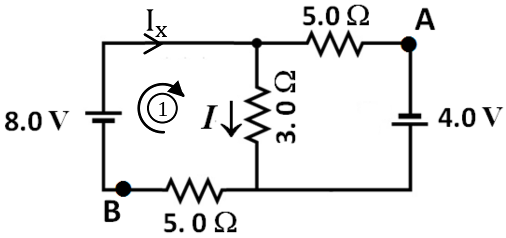
$$+\varepsilon - 3.60\ I - 1.80\ I_1 - 2.40\ I = 0$$

$$\Rightarrow I_1 = \frac{\varepsilon - 6\ I}{1.8} = \frac{25 - (6 \times 3.34)}{1.8} = 2.76\ A$$

Q16.

In the circuit shown in **FIGURE 6**, the current $\boldsymbol{I}$ = 0.36 A. What is the potential difference $\boldsymbol{V_A - V_B}$?

Fig# 6



A) + 2.9 V
B) + 1.1 V
C) − 1.1 V
D) − 2.9 V
E) − 4.7 V

Ans:

Consider Loop 1:

$$+8.0 - 3.0\,\mathrm{I} - 5.0\,\mathrm{I_x} = 0$$

$$\Rightarrow \mathrm{I_x} = \frac{8.0 - 3.0\,\mathrm{I}}{5.0} = \frac{8.0 - 1.08}{5.0} = 1.384\ \mathrm{A}$$

Now, proceed from A → B through the 4.0 V battery:

$$\mathrm{V_A} + 4.0 - 5.0\,\mathrm{I_x} = \mathrm{V_B}$$

$$\Rightarrow \mathrm{V_A} - \mathrm{V_B} = 5.0\,\mathrm{I_x} - 4.0 = +2.9\ \mathrm{V}$$

Q17.

In an RC circuit, a 10-μF capacitor is discharged through a resistor $\boldsymbol{R}$. If the potential difference across the capacitor plates drops to 37 % of its initial value in 2.0 s, then the resistance of $\boldsymbol{R}$ is

A) $2.0 \times 10^5\ \Omega$
B) $1.0 \times 10^5\ \Omega$
C) $5.0 \times 10^5\ \Omega$
D) $1.0 \times 10^6\ \Omega$
E) $2.5 \times 10^6\ \Omega$

Ans:

$$\mathrm{q(t)} = \mathrm{q_0 e^{-t/\tau}} \ \Rightarrow\ \mathrm{V(t)} = \mathrm{V_0 e^{-t/\tau}}$$

$$0.37\,\mathrm{V_0} = \mathrm{V_0 e^{-2t/\tau}} \ \Rightarrow 0.37 = \mathrm{e^{-2/\tau}}$$

$$\Rightarrow\ -\frac{2}{\tau} = ln\,0.37 \Rightarrow\ \tau = -\frac{2}{ln\,0.37} = 2.01\ \mathrm{s}$$

$$\Rightarrow\ \mathrm{RC} = 2.01 \Rightarrow \mathrm{R} = \frac{2.01}{\mathrm{C}} = 2.0 \times 10^5\ \Omega$$

Q18.

What is the magnitude of the magnetic force on a charged particle ($\boldsymbol{Q}$ = + 5.0 μC) moving with a speed of 80 km/s in the positive x direction in a region containing a uniform magnetic field **B** with components $\boldsymbol{B_x}$ = 5.0 T, $\boldsymbol{B_y}$ = 4.0 T, and $\boldsymbol{B_z}$ = 3.0 T?

A) 2.0 N
B) 1.6 N
C) 1.2 N
D) 2.8 N
E) 0.40 N

Ans:

$$\vec{B} = 5.0\,\hat{i} + 4.0\,\hat{j} + 3.0\,\hat{k}\ (T);\ \ \vec{v} = 8 \times 10^4\,\hat{i}\ (m/s)$$

$$\vec{v} \times \vec{B} = 32 \times 10^4\,\hat{k} - 24 \times 10^4\,\hat{j}\ (T.m/s)$$

$$\vec{F}_B = Q(\vec{v} \times \vec{B}) = -1.2\,\hat{j} + 1.6\,\hat{k}\ (N)$$

$$\Rightarrow F_B = 2.0\ N$$

Q19.

An ion with a charge of +3.3 × 10^{-19} C is moving in a region where a uniform electric field of magnitude 5.0 × $10^{4.}$ V/m is perpendicular to a uniform magnetic field of magnitude 0.80 T. If the ion's acceleration is zero then its speed must be (ignore gravity)

A) 6.3 × 10^4 m/s
B) 1.3 × 10^4 m/s
C) 4.0 × 10^5 m/s
D) 3.6 × 10^5 m/s
E) 3.1 × 10^5 m/s

Ans:

$$F_e = F_B:\ \ qE = qvB\ \ \ \Rightarrow v = \frac{E}{B}$$

$$\therefore v = \frac{5.0 \times 10^4}{0.80} = 6.3 \times 10^4\ m/s$$

Q20.

A straight wire, of length 1.0 m, carries a current of 1.0 A in the positive *z* direction in a region where the magnetic field is $\vec{\mathbf{B}} = 3.0\hat{\mathbf{i}} + 2.0\hat{\mathbf{j}} + 1.0\hat{\mathbf{k}}$ (T). The magnitude of the magnetic force on the wire is

A) 3.6 N
B) 5.0 N
C) 4.2 N
D) 3.0 N
E) 1.0 N

Ans:

$\vec{L} = 1.0\ \hat{k}\ \ (\text{m})$

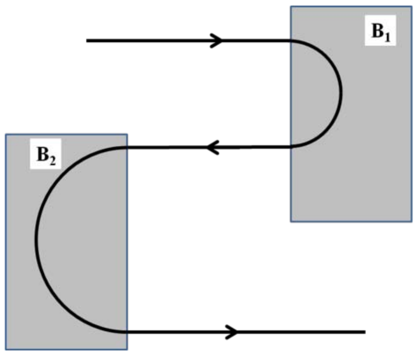
$\vec{F}_B = i\vec{L} \times \vec{B} = \left(1.0\hat{k}\right) \times \left(3.0\ \hat{i} + 2.0\hat{j} + 1.0\ \hat{k}\right)$

$= +3.0\ \hat{j} - 2.0\ \hat{i}\ (\text{N}) \Rightarrow F_B = \sqrt{9+4} = 3.6\ \text{N}$

Q21.

Figure 7 shows the path of an electron that passes through two regions containing uniform magnetic fields $\mathbf{B_1}$ and $\mathbf{B_2}$. Its path in each region is a half circle. Which of the following statements is **CORRECT**?

Fig# 7



A) $\mathbf{B_1}$ has a larger magnitude.✓
B) $\mathbf{B_1}$ has a smaller magnitude.✗
C) The magnitudes of the two fields are equal.✗
D) The two fields point in the same direction.✗
E) The electron spends the same time in both fields.✗

Ans:

Radius: $evB = \dfrac{mv^2}{R}$

$\Rightarrow R = \dfrac{mv}{eB} \Rightarrow R \propto \dfrac{1}{B}$

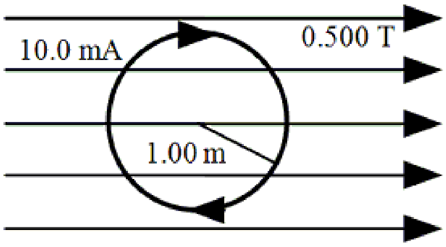
Period: $T = \dfrac{2\pi R}{v} = \dfrac{2\pi}{v} \cdot \dfrac{mv}{eB}$

$\Rightarrow T \propto \dfrac{1}{B}$

Q22.

A single circular loop of radius 1.00 m carries a current of 10.0 mA. It is placed in a uniform magnetic field of magnitude 0.500 T that is directed parallel to the plane of the loop, as shown in **FIGURE 8**. What is the magnitude of the torque exerted on the loop by the magnetic field?

Fig# 8



A) 1.57×10^{-2} N.m
B) 3.14×10^{-2} N.m
C) 6.28×10^{-2} N.m
D) 9.28×10^{-2} N.m
E) Zero

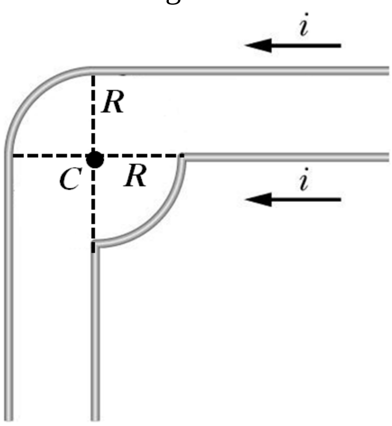
Ans:

$$\vec{\tau} = \vec{\mu} \times \vec{B} = i\vec{A} \times \vec{B}$$
$$= (10.0 \times 10^{-3})(\pi \times 1.0)\left(-\hat{k}\right) \times \left(0.5\ \hat{i}\right)$$
$$= (5\pi \times 10^{-3})\left(-\hat{k} \times \hat{i}\right) = -5\pi \times 10^{-3}\ \hat{j}$$
$$\Rightarrow \tau = 5\pi \times 10^{-3} = 1.57 \times 10^{-2}\ \text{N.m}$$

Q23.

In **FIGURE 9**, two infinitely long wires carry currents $\boldsymbol{i}$. Each follows a 90° arc on the circumference of the same circle of radius $\boldsymbol{R}$. What is the magnitude of the net magnetic field at the center of the circle (point C)?

Fig# 8



A) $\dfrac{\mu_o i}{2\pi R}$

B) $\dfrac{\mu_o i}{\pi R}$

C) $\dfrac{\mu_o i}{4\pi R}$

D) $\dfrac{\mu_o i}{2\pi R} + \dfrac{\mu_o i}{16R}$

E) $\dfrac{\mu_o i}{\pi R} + \dfrac{\mu_o i}{16R}$

Ans:

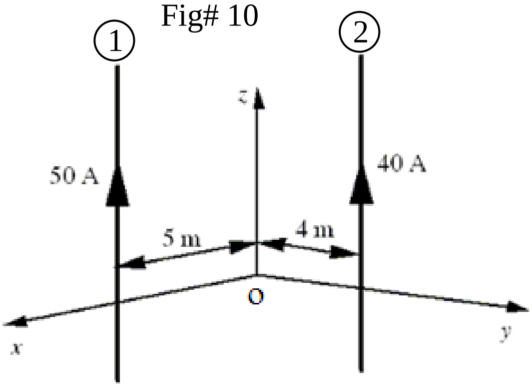
* The magnetic fields due to the circular sections cancel.
* The straight lower current does not produce any magnetic field
* We are left with the top straight wire:

$$B_c = 2 \times \text{semi} - \text{infinite wires}$$
$$= 2 \times \frac{\mu_0 i}{4\pi R} = \frac{\mu_0 i}{2\pi R}$$

Q24.

FIGURE 10 shows two long, thin wires, parallel to the *z* axis, carrying currents in the positive *z* direction. The 50-A wire is in the *x*-*z* plane and is 5 m from the *z* axis. The 40-A wire is in the *y*-*z* plane and is 4 m from the *z* axis. What is the net magnetic field at the origin O due to the two wires?

Fig# 10



A) $(2\hat{i} - 2\hat{j})\ \mu T$
B) $(2\hat{i} + 2\hat{j})\ \mu T$
C) $(2\hat{i} + 3\hat{j})\ \mu T$
D) $(2\hat{i} - 3\hat{j})\ \mu T$
E) $(3\hat{i} + 2\hat{j})\ \mu T$

Ans:

$$\vec{B}_1 = \frac{\mu_0 i_1}{2\pi d_1}\left(-\hat{j}\right)$$

$$= \frac{4\pi \times 10^{-7} \times 50}{2\pi \times 5}\left(-\hat{j}\right) = -2 \times 10^{-6}\hat{j}\,(T) = -2\hat{j}\ (\mu T)$$

$$\vec{B}_2 = +\frac{\mu_0 i_2}{2\pi d_2}\ \hat{i}$$

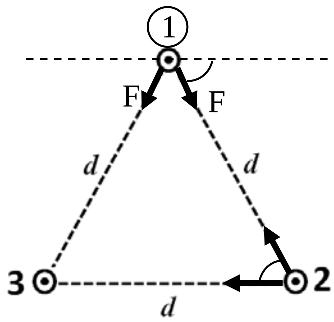
$$= \frac{4\pi \times 10^{-7} \times 40}{2\pi \times 4}\left(\hat{i}\right) = +2\hat{i}\ (\mu T)$$

$$\therefore\ \vec{B}_{net} = \left(2\,\hat{i} - 2\hat{j}\right)\mu T$$

Q25.

FIGURE 11 shows a cross section of three parallel wires each carrying a current of 5.0 A out of the paper. If the distance ***d*** = 6.0 mm, what is the magnitude of the net magnetic force on a 2.0-m length of wire 1?

Fig# 11



A) 2.9 mN
B) 3.3 mN
C) 2.1 mN
D) 3.9 mN
E) 1.7 mN

Ans:

$$F = \frac{\mu_0 L i^2}{2\pi d} = \frac{4\pi \times 10^{-7} \times 2 \times 25}{2\pi \times 6 \times 10^{-3}}$$

$$= 1.67 \times 10^{-3}\ N$$

$$F_{net} = 2.F.\sin 60 = 2.9 \times 10^{-3}\ N$$

Q26.

A long, solid, cylindrical wire carries a uniformly distributed current. If the radius of the wire is 3.5 mm, and the magnitude of the current density is 1.5 A/cm^2, what is the magnitude of the magnetic field at a distance of 2.5 mm from the axis of the wire?

A) 2.4×10^{-5} T
B) 3.3×10^{-5} T
C) 1.3×10^{-5} T
D) 6.9×10^{-5} T
E) zero

Ans:

$$\oint \vec{B} \cdot d\vec{s} = = \mu_0 i_{enc} \Rightarrow B(2\pi r) = \mu_0 . J . A = \mu_0 J . \pi r^2$$

$$B = \frac{\mu_0 J r}{2} = \frac{4\pi \times 10^{-7} \times 1.5 \times 10^4 \times 2.5 \times 10^{-3}}{2} = 2.4 \times 10^{-5} \text{ T}$$

Q27.

A solenoid with ***N*** turns carries a current of 2.000 A, and has a length of 34.00 cm. If the magnitude of the magnetic field generated at the center of the solenoid is 9.000 mT, what is the value of ***N***?

A) 1218
B) 1591
C) 2318
D) 3183
E) 2078

Ans:

$$B = \mu_0 n_i = \frac{\mu_0 N_i}{L}$$

$$\Rightarrow N = \frac{B.L}{\mu_0 . i} = \frac{9 \times 10^{-3} \times 0.34}{u\pi \times 10^{-7} \times 2} = 1218$$

Q28.

A conducting loop is held in a uniform magnetic field, with the plane of the loop perpendicular to the field lines. Which of the following will **NOT** cause a current to be induced in the loop?

A) Keeping the orientation of the loop fixed and moving it within the field.✓
B) Shrinking the loop.✗
C) Changing the shape of the loop.✗
D) Rotating the loop about an axis perpendicular to the field lines.✗
E) Pulling the loop out of the field.✗

Q29.

A 50-turn coil is positioned in a magnetic field so that the normal to the plane of the coil makes an angle of 60° with the direction of the field. When the magnetic field is increased uniformly from 200 μT to 600 μT in 0.40 s, an emf of magnitude 80 mV is induced in the coil. What is the cross sectional area of the coil?

A) 3.2 m²
B) 1.6 m²
C) 4.4 m²
D) 2.5 m²
E) 2.1 m²

Ans:

$$\varepsilon_{ind} = \frac{\Delta\phi}{\Delta t} = \frac{\Delta}{\Delta t}(NBA\cos\theta) = NA\cos\theta\frac{\Delta B}{\Delta t}$$

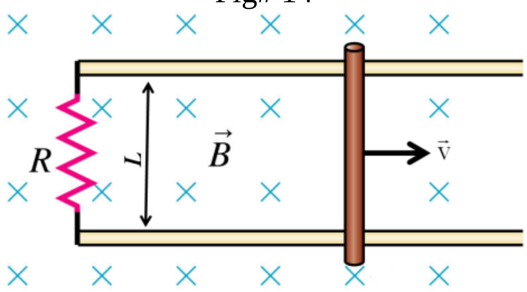
$$\Rightarrow A = \frac{\varepsilon_{ind}}{N.\cos\theta(\Delta B/\Delta t)} = \frac{\varepsilon_{ind}.\Delta t}{N.\cos\theta.\Delta B} = \frac{80\times10^{-3}\times0.40}{50\times0.5\times400\times10^{-6}} = 3.2\text{ m}^2$$

Q30.

A conducting bar of length ***L*** moves to the right on two frictionless rails with constant velocity **v**, as shown in **FIGURE 14**. A uniform magnetic field directed into the page has a magnitude of 0.30 T. Assume ***R*** = 9.0 Ω, ***L*** = 0.35 m, and ***v*** = 2.0 m/s. What is the current induced in the resistor?

A) 0.023 A, counterclockwise
B) 0.023 A, clockwise
C) 0.21 A, clockwise
D) 0.21 A, counterclockwise
E) 0.047 A, clockwise

Fig# 14



Ans:

$$\varepsilon_{ind} = BLv$$

$$i_{ind} = \frac{BLv}{R} = \frac{0.3\times0.35\times2}{0.023\text{ A}}$$

$$= 0.023\text{ A counterclockwise}$$
