Time left 0:59:11

A 36-turn solenoid of length 6.10 cm produces a uniform magnetic field of magnitude 2.40 mT at its center. What is the current (in A) in the solenoid?

- a. 0.81
- b. 1.62
- c. 3.24
- d. 4.85
- e. 6.47

Next page

P.1 $B = \mu_0 N I$

$$I = \frac{B L}{\mu_0 N} = \frac{(2.46 \times 10^{-3})(6.10 \times 10^{-2})}{(4\pi \times 10^{-7})(36)}$$

$= 3.236 \simeq 3.234\ A \rightarrow$ C ✓

Time left 0:54:26

A laboratory electromagnet produces a magnetic field of magnitude 2.00 T. A proton moves through this field with a speed of 5.96×10^{6} m/s. What is the magnitude (in N) of the maximum magnetic force that could be exerted on the proton?

- a. 1.53×10^{-12}
- b. 1.75×10^{-12}
- c. 1.91×10^{-12}
- d. 2.38×10^{-12}
- e. 2.86×10^{-12}

$B = 2.00\,T$ $\quad v = 5.96 \times 10^6\ m/s$

$F = q(\vec{v} \times \vec{B}) \rightarrow -F = qvB\sin\theta$

the max magnetic force will be experinced when $\dfrac{\sin\theta = 1}{\theta = 90^\circ}$

$F_{max} = (1.6 \times 10^{-19})(6 \times 10^6)(2)$

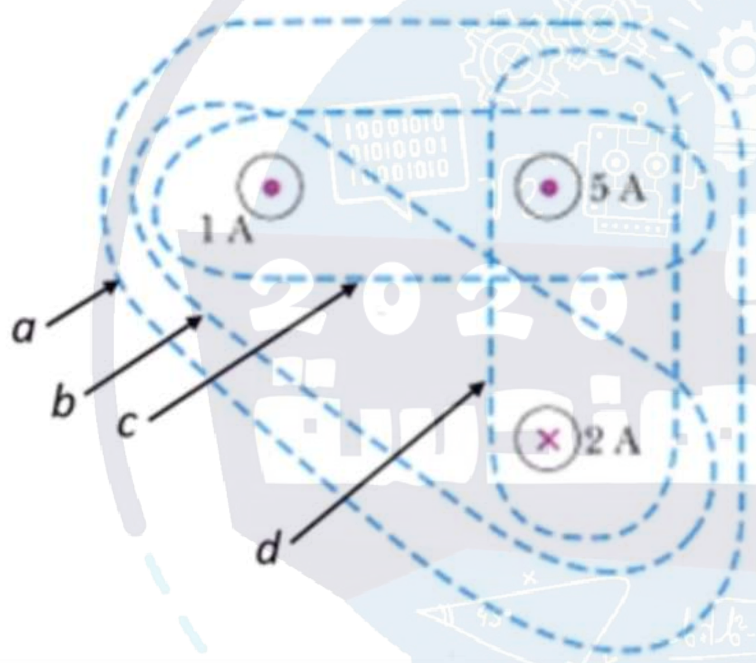
$= 1.91 \times 10^{-12}$

C

Time left 0:50:02

For the closed path labeled (*b*), the magnitude (in μT.m) of the line integral

$$\oint \vec{B}.d\vec{l} \text{ is}$$



- a. 0.63
- b. 1.26
- c. 3.77
- d. 5.03
- e. 7.54

Q3: $\int \vec{B}\, d\vec{l} = \mu_0 (I_1 - I_2)$

$I_1 = 1A$

$I_2 = 2A$

$I_3 = 5A$

$= 4\pi \times 10^{-7} (1-2)$

$= 1.26\ \mu T.m$ [b]

Time left 0:43:54

Useful Constants

$k_e = 1/4\pi\varepsilon_o$ = 9 x 10^9 $N.m^2/C^2$; ε_o = 8.85x10^{-12} $C^2/N.m^2$; e = 1.6x10^{-19} C; $m_{electron}$ = 9.11 x 10^{-31} kg; m_{proton} = 1.67 x 10^{-27} kg; g = 9.8 m/s^2

A certain parallel plate capacitor stores 850.0 J of energy when it holds 6.0 × 10^{-3} C of charge. What is the potential difference (in V) across the plates?

- a. 2.4×10^5
- b. 1.8×10^6
- c. 2.8×10^5
- d. 3.0×10^5
- e. 2.0×10^4

$$U = \frac{1}{2} \cdot q \cdot V$$

$$\frac{850}{0.5(6\times10^{-3})} = \frac{\frac{1}{2}(6\times10^{-3}) \cdot V}{0.5(6\times10^{-3})} = 2.8\times10^{5} \text{ volt}$$

C

Time left 0:40:46

A 43 turn rectangular coil of area 5.0 X 10^{-3} m^2 is allowed to fall from a position where $B = 0$ to a new position where $B = 0.550$ T, while the magnetic field is directed perpendicular to the plane of the coil during the entire motion. Calculate the magnitude of the average emf (in mV) that is induced in the coil if the motion occurs in 0.170 s.

- a. 696
- b. 569
- c. 723
- d. 443
- e. 316

6 induced emf = $e = NA\frac{dB}{dt}$

$$e = 43(5\times10^{-3})\left(\frac{0.55}{0.17}\right)$$

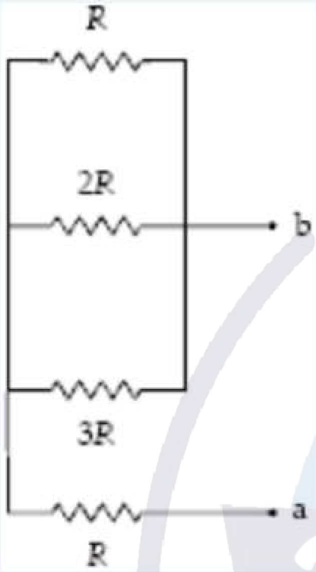
$e = 0.696$ volt

$= 696$ mV

(a)

Time left 0:34:43

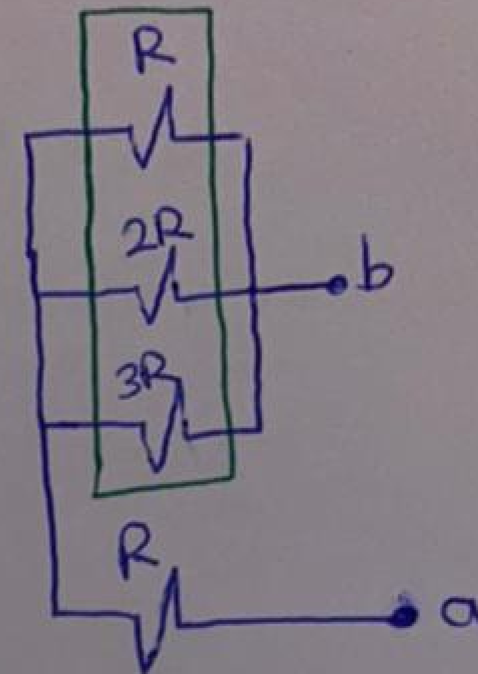
What is the equivalent resistance (in Ω) between points a and b when R = 13 Ω?



- a. 29
- b. 23
- c. 26
- d. 20
- e. 4.6

$R = 13\ \Omega$

$R_{equivalent} = ?$

1) 

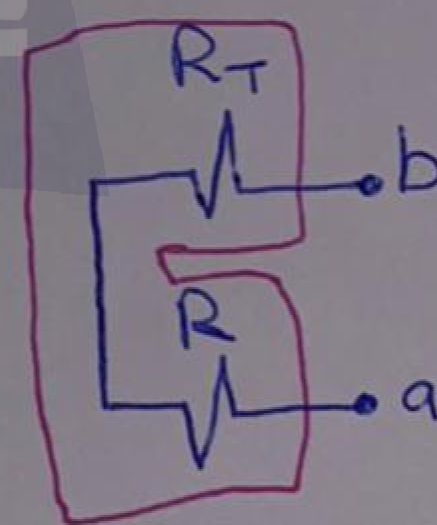
1) In <u>Green</u>: Parallel

$$\frac{1}{R_T} = \frac{1}{R} + \frac{1}{2R} + \frac{1}{3R}$$

$$\frac{1}{R_T} = \frac{6}{6R} + \frac{3}{6R} + \frac{2}{6R} = \frac{11}{6R}$$

$$\Rightarrow R_T = \frac{6R}{11}\ \Omega$$

2) In <u>Pink</u>: Series

2) 

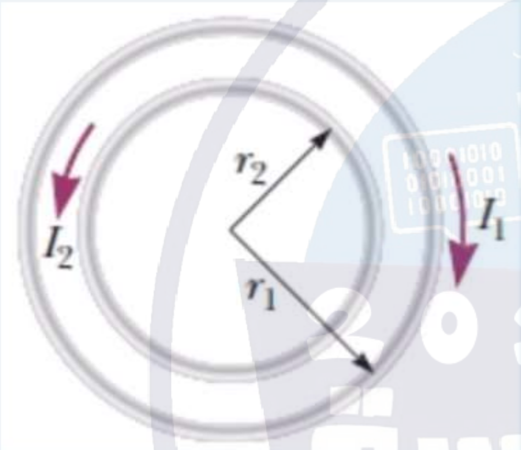
$$R_{equ.} = R_T + R$$

$$R_{equ.} = \frac{6R}{11} + R = \frac{17R}{11}$$

$$R = 13 \Longrightarrow R_{equ.} = \frac{17 * 13}{11} = 20.09\ \Omega$$

Time left 0:30:58

Two coplanar and concentric circular loops of wire carry currents of I_1 = 1.50 A and I_2 = 2.30 A in opposite directions as in the figure below. Let r_1 = 12.0 cm and r_2 = 8.70 cm. What is the magnitude (in µT) and direction of the net magnetic field at the center of the two loops?



- a. 16.4 into the page
- b. 12.1 into the page
- c. 9.6 into the page
- d. 3.5 out of the page
- e. 8.8 out of the page

Q8: $B = \frac{\mu}{2}\left(\frac{I_1}{r_1} - \frac{I_2}{r_2}\right)$

$= \frac{4\pi \times 10^{-7}}{2}\left(\frac{1.5}{0.12} - \frac{2.3}{0.087}\right)$

$= 8.8$ out of the page [e]

Time left 0:25:26

Useful Constants

$k_e = 1/4\pi\varepsilon_o = 9 \times 10^9$ N.m^2/C^2; $\varepsilon_o = 8.85\text{x}10^{-12}$ C^2/N.m^2; e = $1.6\text{x}10^{-19}$ C; $m_{electron} = 9.11 \times 10^{-31}$ kg; $m_{proton} = 1.67 \times 10^{-27}$ kg; g = 9.8 m/s^2

An 8.5-pF parallel-plate capacitor is charged by connecting it to a 12.0-V battery. The battery is then disconnected and a slab of material of dielectric constant k = 3 is inserted into the capacitor such that it fully fills the space between the plates. The amount (in pJ) by which the energy stored in the capacitor decreases after the dielectric is inserted is

- a. 525
- b. 459
- c. 490
- d. 505
- e. 408

Next page

Q9: $Q = CV = 8.5 \times 10^{-12} \times 12 = 1.02 \times 10^{-10}\,C$

$C' = KC = 3 \times 8.5 \times 10^{-12} = 2.55 \times 10^{-11}\,F$

$$\Delta E = \frac{Q^2}{2C} - \frac{Q^2}{2C'} = \frac{Q^2}{2}\left[\frac{1}{C} - \frac{1}{C'}\right]$$

$$= \frac{Q^2}{2C}\left[1 - \frac{1}{k}\right] = \frac{Q^2}{2C}(0.666)$$

$$= \frac{(1.02 \times 10^{-10})^2}{2\,(8.5)(10^{-12})} \times 0.666 = 407.59\,pJ$$

$\approx 408\,pJ$ [e]

m/s², $\mu_o = 4\pi \times 10^{-7}$ T.m/A

Time left 0:20:01

A magnetic field of 0.200 T exists within a solenoid of 340 turns and a diameter of 10.0 cm. Within what time period (in μs) must the field be reduced to zero if the magnitude of the average induced emf within the solenoid during this time interval is to be 9.0 kV?

- a. 80
- b. 75
- c. 68
- d. 59
- e. 36

Next page

Q10

$N = 340$

$B_i = 0.2T \quad B_f = 0T$

$\mathcal{E} = 9kV = 9000V$

Area of loop is $A = \frac{\pi D^2}{4}$

$$e = \frac{d}{dt}(NBA) = -NA\frac{dB}{dt} = \frac{-340\left(\frac{\pi(0.1)^2}{4}\right)(0-0.2)}{t}$$

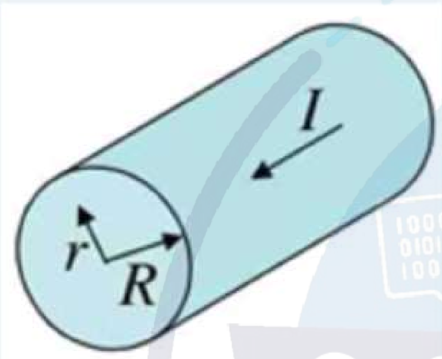
$$9000 = \frac{-340\left(\frac{\pi(0.1)^2}{4}\right)(-0.2)}{t}$$

Solve for time $\Rightarrow$ $t = 5.93 \times 10^{-5}$ Sec

$= 59 \mu sec$ **d**

Time left 0:16:02

A long, straight wire of radius R = 10.00 mm carries a steady current I that is uniformly distributed through the cross section of the wire with current density $J = 3.00 \times 10^5$ A/m^2. The magnetic field (in mT) a distance r = 8.00 mm from the axis of the wire is



- a. 0.75
- b. 0.94
- c. 1.13
- d. 1.32
- e. 1.51

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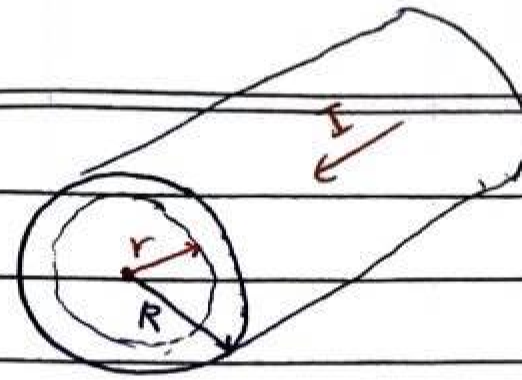


for $r \leq R$

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{enclosed}$$

$\downarrow$

$$\oint B \cdot dl = B \oint dl = B \times l$$

B is constant; l = circumference (المحيط)

$$B \times 2\pi r = \mu_0 I_{enclosed} = \mu_0 \times \left(\frac{\text{New area}}{\text{area total}}\right) I$$

$$B \times 2\pi r = \mu_0 \left(\frac{\pi r^2}{\pi R^2}\right) I$$

$$B = \left(\frac{\mu_0 I}{2\pi R^2}\right) r = \frac{4\pi \times 10^{-7} \times 60.31 \times 8 \times 10^{-3}}{2\pi \times (10 \times 10^{-3})^2}$$

$$= 0.965 \times 10^{-3}\,T = 0.965\,mT$$

$$I = \iint J\,da$$

$$I = J \oint da$$

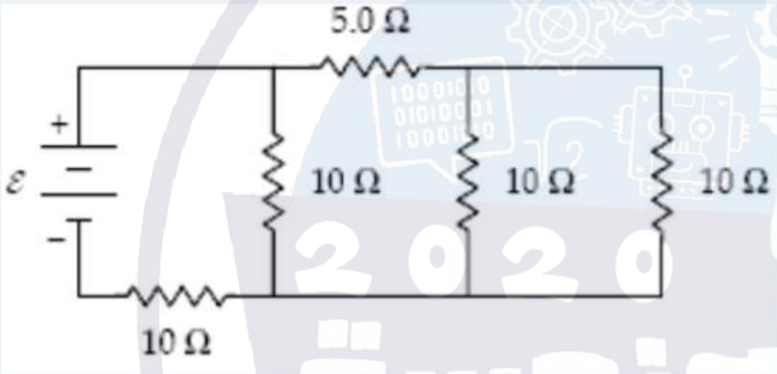
$$I = J \times \pi r^2$$

$$I = 3 \times 10^{5} \times \pi \times (8 \times 10^{-3})^2$$

$$I = 60.31\,A$$

$= 1.6\text{x}10^{-19}$ C; $m_{electron} = 9.11 \times 10^{-31}$ kg; m_{pro} Time left 0:10:18
10^{-27} kg; g = 9.8 m/s^2

At what rate (in W) is thermal energy generated in the 5-Ω resistor when ε = 24 V?



- a. 13
- b. 3.2
- c. 23
- d. 39
- e. 51

Next page

→ parallel → $\frac{1}{R} = \frac{1}{10} + \frac{1}{10} \Rightarrow R = 5\ \Omega$

$R_{ser} = 5 + 5 = 10\ \Omega$

$I_1 = I_2$ (both $R = 10\ \Omega$)

$I = I_1 + I_2 \Rightarrow I_1 = I/2 / I_2 = I/2$

$24 - I(10) - I_2(10) = 0 \longrightarrow I = 1.6\,A$

$P = RI^2 \Rightarrow P = 5(1.6)^2 = 12.8$

$\approx 13\ W$ **A**

Time left 0:07:34

A wire carries a steady current of 2.60 A. A straight section of the wire is 0.850 m long and lies along the *y*-axis within a uniform magnetic field, **B**=(1.70 **k**) T. If the current is in the negative *y*-direction, what is the magnetic force (in N) on this section of wire? (Note: **i**, **j**, and **k** are the cartesian unit vectors.)

- a. −3.76 **i**
- b. −2.87 **j**
- c. −1.28 **k**
- d. 3.76 **i**
- e. 2.87 **j**

Next page

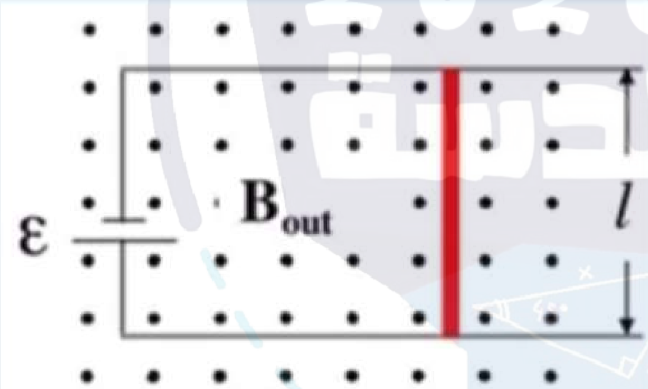
Q13: $F = IL \times B$

$= 2.6 \times 0.85 \times 1.7(-i)$

$= -3.757N$ [a]

Time left 0:05:52

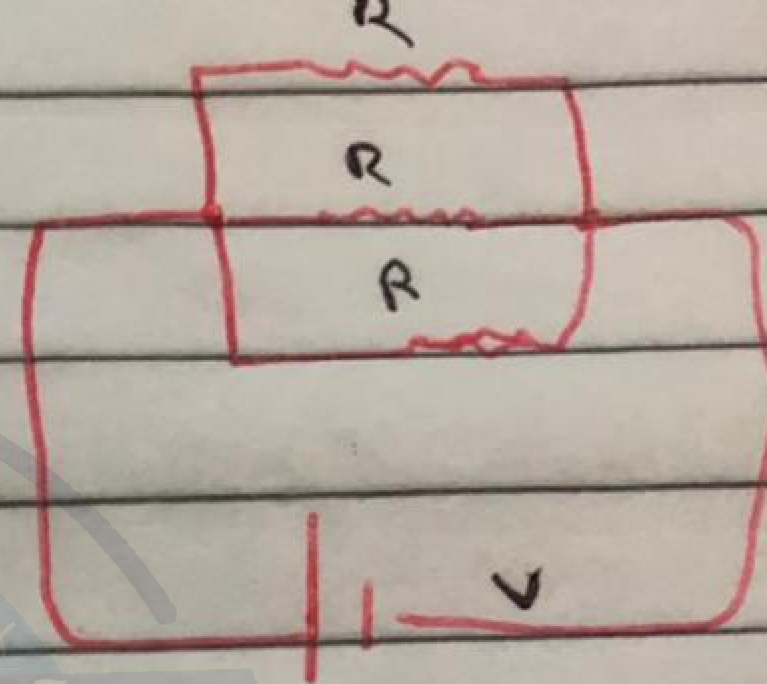
A conducting bar of mass m = 0.2 kg, length l = 0.5 m, and resistance R slides in a horizontal plane on two frictionless and resistance free parallel rails in a uniform magnetic field B = 0.1 T that is directed perpendicular to the plane as shown in the figure. A source of emf that maintains a constant current I = 2 A in the circuit (by compensating for any induced current) is connected between the rails. Assuming the bar starts from rest at t = 0, the speed (in m/s) of the rod at t = 1.0 s is



- a. 1.5
- b. 1.0
- c. 0.75
- d. 0.50
- e. 0.25

$R_{eq} = \frac{R}{3}$

Power consumed $= \frac{3V^2}{R}$



$F = I \times L \times B$

$2A \times 0.5m \times 0.1 = \boxed{0.1}$

$a = \frac{0.1}{m} = \frac{0.1}{0.2} = 0.5 \ m/s^2$

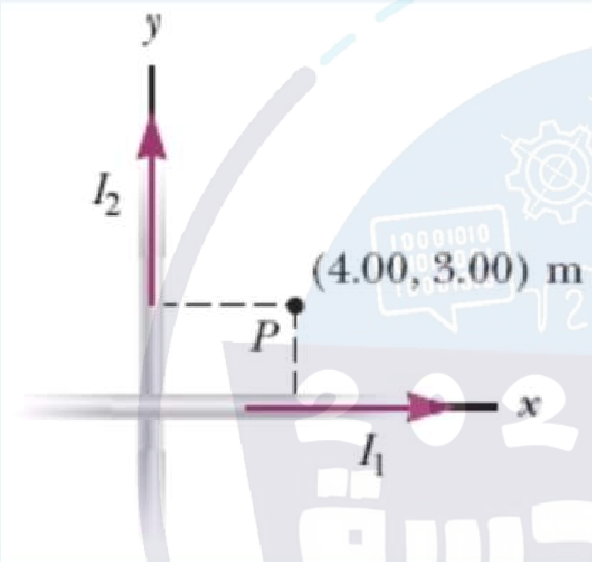
$V = u + at$ $\quad V = ? \quad u = 0 \quad a = 0.5$

$t = 1 s$

$V = 0 + 1 \times 0.5 = \boxed{0.5 \ m/s}$ $\boxed{d✓}$

Time left 0:02:49

A wire carries a 1.00-A current along the *x* axis, and another wire carries a 5.40-A current along the *y* axis, as shown in the figure. What are the magnitude (in μT) and direction of the magnetic field at point *P*, located at $x = 4.00$ m, $y = 3.00$ m?



a. 0.50 into the page

b. 0.10 into the page

c. 0.20 into the page

d. 0.15 out of the page

e. 0.25 out of the page

Finish attempt ...

(15) At Point P

$$B_{net} = B_1 - B_2 = \frac{\mu_0}{2\pi}\left(\frac{I_1}{r_1} - \frac{I_2}{r_2}\right)$$

$$= \frac{4\pi \times 10^{-7}}{2\pi} \times \left(\frac{1}{3} - \frac{5.40}{4}\right)$$

$\therefore$ $-0.20\ \mu T$

into the page