= KEY =

Welcome to the homework page test1. If this isn't you then please go back to the homework login page.

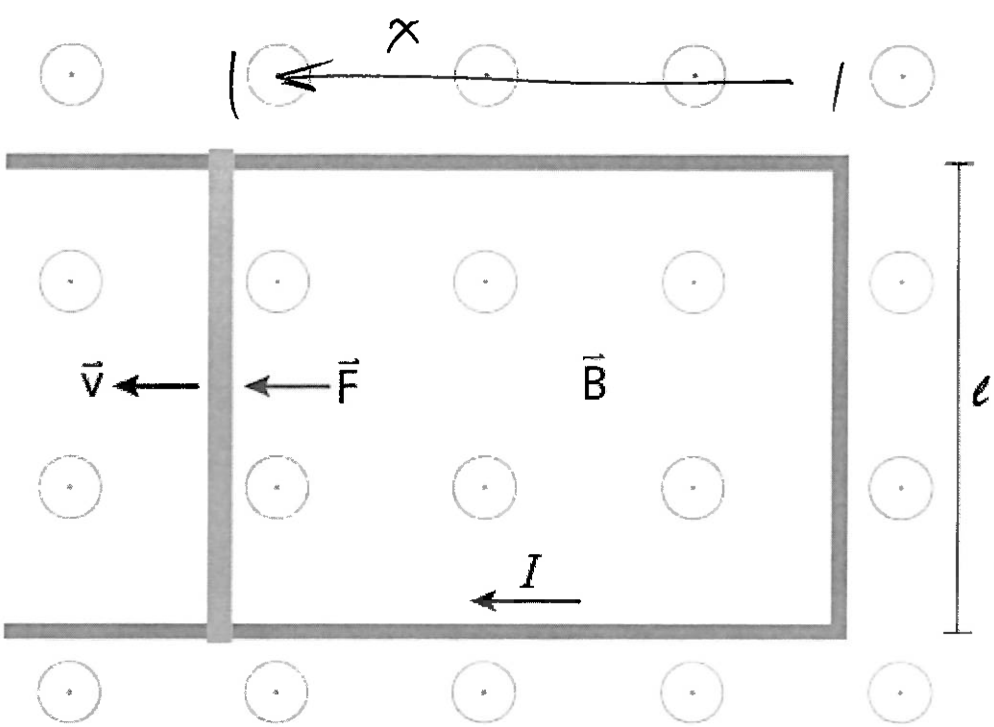
You may log out and return later if you wish without losing any saved data. You will have **TEN** attempts for each assigned problem. Every unsuccessful attempt will lower that part of the problem's value by 5%.

For example, if you get it right on the first try, then you will receive 100% for that problem. If you are twice incorrect and submit the correct on the third try, then you will receive a 90% for that part of the problem. You will not recieve any points for that part of the problem after 10 attempts.

You do not have to answer all the problems during a single session or in any particular order. To answer a problem simply type the numerical value in the box provided, check the box to the right of the part(s) you want to answer, and then click the submit button. You can freely log in and out of the homework page without losing any submitted information so feel free to take breaks if necessary.

LET'S BEGIN!

Problem #1



A metal rod having electrical resistance R = 0.410Ω slides on rails as shown. Assume that the rails have no electrical resistance and together they all make a rectangular circuit of width ℓ = 55.0cm with the length changing as the rod moves. A magnetic field of magnitude $|\mathbf{B}|$ = 0.650T is in the direction normal to the rectangle and points out of the page. The bar is moving at a constant velocity of $|\mathbf{v}|$ = 5.80m/s. (a) What is the magnitude of the current in the rectangular circuit? (b) What is the magnitude of the force required to keep the bar moving at this constant velocity?

(a) 5.06 A Answer part (a)

(b) 1.81 N Answer part (b)

Submit

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

a) $V = -\frac{d\phi_M}{dt}$ $\Phi_M = B\ell x$

$V = B\ell\frac{dx}{dt} = B\ell v$

$I = \frac{V}{R} = \frac{B\ell v}{R} = \frac{(0.65)(.55)(5.8)}{0.41}$

$\boxed{I = 5.06 \text{ AMPS}}$

b) $F = BI\ell = (0.65)(.55)(5.06)$

$\boxed{F = 1.81 \text{ N}}$

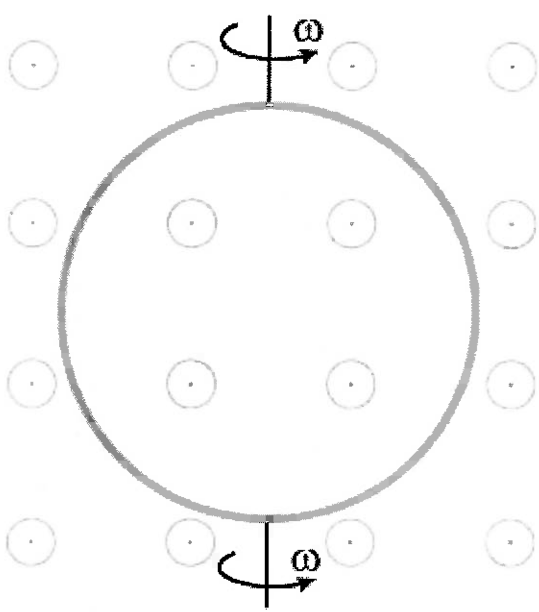
Problem #2

SO NOTE $\Phi_M = \pi r^2 B\, C_{\omega t}$ AND SO

$V = -\frac{d\Phi_M}{dt} = \underbrace{\pi r^2 B\omega}\, S_{\omega t}$

a) $V_{PEAK} = \pi(.48)^2(.95)11$

$= \boxed{7.56 \text{ VOLTS}}$



A wire circle (radius r = 48.0cm) is rotates as shown in a constant $|\mathbf{B}|$ = 0.950T magnetic field. It does so with angular frequency ω = 11.0rad/s and has resistance of 0.800Ω. Calculate (a) the peak emf and (b) the maximum current through the loop while rotating. At t = 0 the loop and magnetic field are oriented as depicted in the above diagram. At t = 2.60s, what are the magnitudes of the (c) emf and (d) current?

(a) 7.56 V ✓ Answer part (a)

(b) 9.45 A ✓ Answer part (b)

(c) -2.13 V ✓ Answer part (c)

(d) -2.67 A ✓ Answer part (d)

Submit

b) $I_{MAX} = \frac{V_{MAX}}{R} = \frac{7.56}{0.8} = \boxed{9.45 \text{ AMPS}}$

c) BE CAREFUL! ωt IN RADIANS.

$V = V_{PEAK} \sin \omega t = 7.56 \sin(11.2 \cdot 2.6 \text{ RADIANS})$

$= 1636°$

$\boxed{V = -2.13 \text{ V}}$

d) $I = \frac{V}{R} = \boxed{-2.67 \text{ AMPS}}$

Attempted part (a) 0 times, part (b) 0 times, part (c) 0 times, and part (d) 0 times.

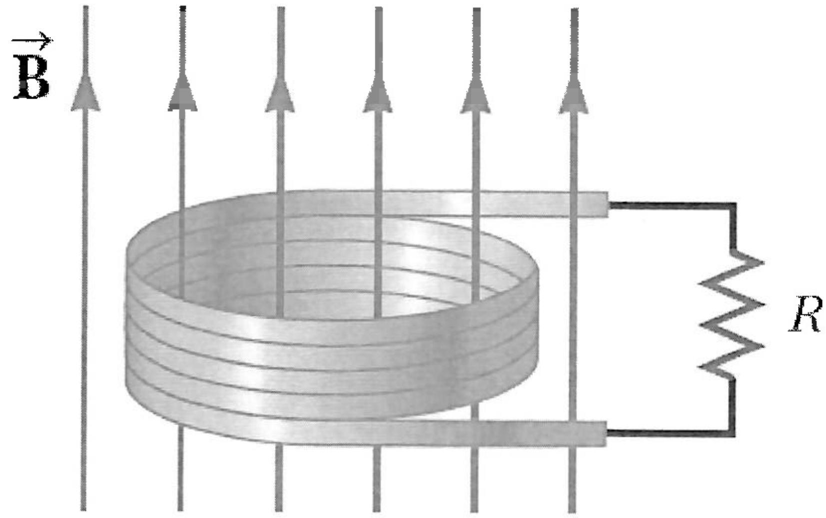
There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

There have been no attempts to answer part (c)

There have been no attempts to answer part (d)

Problem #3



$\phi_0 = \pi r^2 B$
$= (22\times10^{-4} m^2)(1.3)$
$\boxed{\phi_0 = 0.00286}$

A coil with N = 381 turns and no electrical resistance has a cross-sectional area A = 22.0cm^2. The wire ends are connect with resistor R = 5.00Ω as shown. It is all immersed in a uniform magnetic field |**B**| = 1.30T pointing upward and normal the cross-sectional area. The direction of the field then completely reverses its direction over a time interval of Δt = 0.500s. (a) What was the magnitude of the average current in the wire? (b) How much charge entered one end of the resistor during that time interval?

(a) ~~0.00229~~ 0.869 A ✓ Answer part (a)

(b) 0.434 C ✓ Answer part (b)

Submit

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

$\Delta\phi = 2\phi_0 N$

$V = -\frac{\Delta\phi}{\Delta t} = \frac{2(0.00286)(381)}{0.5}$

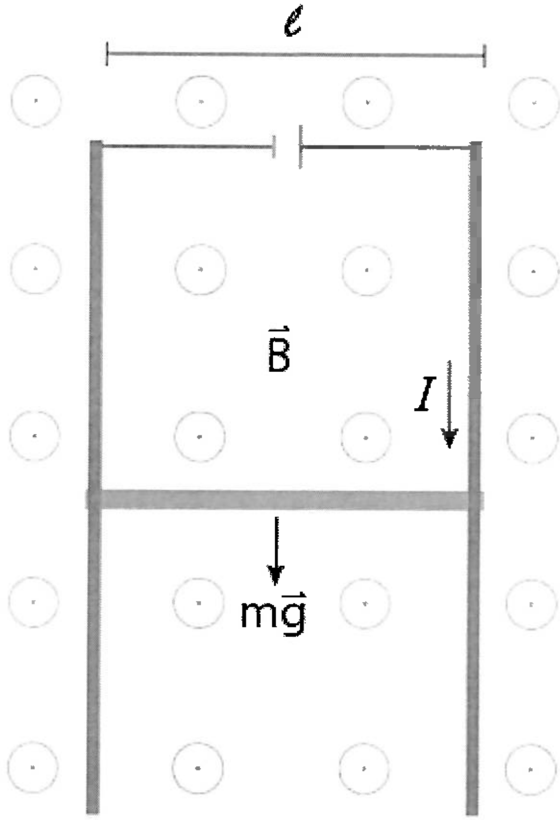
$V = 0.0114$ Volts $(381) = 4.34V$

$I = \frac{V}{R} = \frac{4.34}{5} = \boxed{0.869 \text{ AMPS}}$

b) $Q = I\Delta t = (0.869)(.5)$

$\boxed{Q = 0.434 \text{ COULOMBS}}$

Problem #4



a) $\Sigma F = 0 \Rightarrow F_{MAG} = F_{GRAV}$

$BI\ell = mg$

$(1.2) I (.78) = (0.23)(9.8)$

$\Rightarrow \boxed{I = 2.41 \text{ AMPS}}$

So $V = IR = (2.41)(1.1) = 2.65$ VOLTS

A metal bar is allowed to slide along the vertical direction in a gravitational field, as shown. It has mass m = 0.23kg, and an electrical resistance of R = 1.10Ω. It slides without friction on two perfectly conducting rails that are connected at one end by a power supply as illustrated. The two rails are separated by a distance ℓ = 78.0cm. A magnetic field is perpendicular to the plane that the bar and rails make and has a magnitude of $|\mathbf{B}|$ = 1.20T. (a) Suppose the initial velocity is zero, then What must the potential difference across the power supply be for the bar to stay at its current location (hint: chapter 29 material)? (b) Let us assume that we remove the power supply. The total force on the object will be $F_{tot} = F_{gravity} - F_{mag}$, and therefore, m(dv/dt) = mg - $I\ell B$. Substituting IR = $B\ell v$ into the differential equation gives m(dv/dt) = mg - $B^2\ell^2 v/R$, which is an inhomogeneous differential equation. Upon solving this equation for the bar initially at rest, we find that $\boxed{v = g\tau(1-e^{-t/\tau})}$ where $\tau = mR/B^2\ell^2$. What is the maximum velocity that the bar can achieve?

(a) 2.65 V ☑ Answer part (a)

(b) 2.83 m/s ☐ Answer part (b)

Submit

is $t \to \infty$

$V_{MAX} = g\tau = \frac{gmR}{B^2\ell^2}$

$V_{MAX} = \frac{(9.8)(.23)(1.1)}{(1.2)^2(.78)^2}$

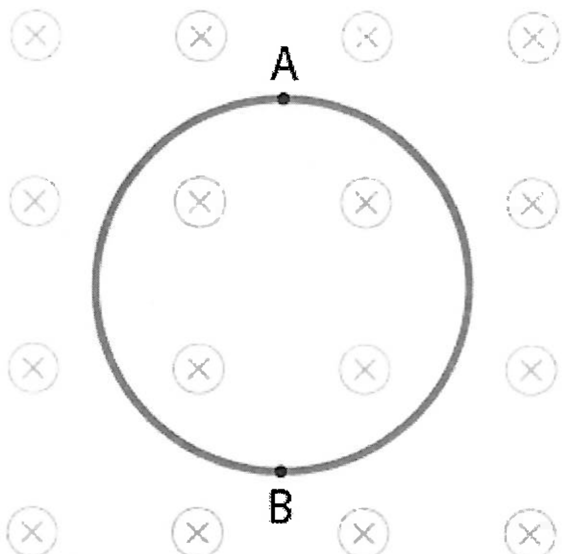
$\boxed{V_{MAX} = 2.83 \text{ m/s}}$

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

Problem #5



$\phi_0 = \pi r^2 B \quad \phi_{FINAL} = 0$

$\Delta\phi = -\pi r^2 B = \phi_{FINAL} - \phi_0$

$V = -\frac{\Delta\phi}{\Delta t} = \frac{\pi r^2 B}{\Delta t}$

$V = \frac{\pi(.41)^2(.43)}{0.13} = \boxed{1.75\ V}$

A conducting thin circular hoop is of radius of r = 41.0cm. Placed in a uniform magnetic field of strength |**B**| = 0.430T the loop is pulled at points A and B so as to collapse the hoop. If it takes 0.130s to close the loop then what is the magnitude of the average induced emf in it during that time interval?

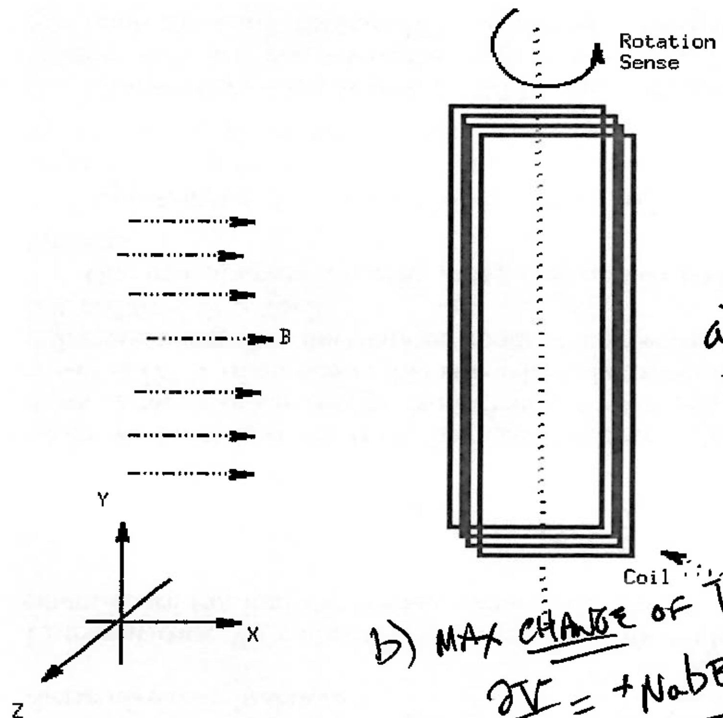
1.75 V ☑ Answer the question

Submit

Attempted the problem 0 times.

There have been no attempts to answer the problem

Problem #6



So $\Phi_M = NabBS_{\omega t}$

$V = -\frac{d\Phi_M}{dt} = -Nab\omega BC_{\omega t}$ $(C_{\omega t} = -1)$

a) MAX $V = Nab\omega B$

$V_{MAX} = (59)(.12)(.23)(1.2)(8)$

$\boxed{V_{MAX} = 15.63 \text{ VOLTS}}$

b) MAX CHANGE OF V

$\frac{\partial V}{\partial t} = +\underbrace{NabB\omega^2}\, S_{\omega t}$

MAX RATE OF CHANGE $= 59(.12)(.23)(1.2)(8)^2 = (15.63)(8) = \boxed{125.1}$

A rectangular coil of N = 59 turns with side lengths of a = 0.120m and b = 0.230m that carries a resistance of R = 11.0Ω rotates with an angular speed of ω = 8.00rad/s about the y-axis in a magnetic field. The magnitude of the magnetic field is |**B**| = 1.20T and is oriented along the x-axis. We take t = 0 to be the time when the magnetic field is in the direction normal to the plane of the rectangle. Calculate (a) the maximum induced emf in the coil, (b) the maximum rate of change of the induced emf in the coil, (c) the maximum current in the coil, (d) the maximum rate of current change in the coil.

$\boxed{I_{MAX} = \frac{V_{MAX}}{R} = 1.42 \text{ AMPS}}$

(a) 15.63 V ☑ Answer part (a)

(b) 125.1 V/s ☑ Answer part (b)

$\left.\frac{dI}{dt}\right|_{MAX} = \frac{1}{R}\frac{dV_{MAX}}{dt} = \frac{125.1}{11\Omega}$

$\boxed{= 11.37 \text{ A/s}}$

(c) 1.42 A ☑ Answer part (c)

(d) 11.37 A/s ☑ Answer part (d)

Submit

Attempted part (a) 0 times, part (b) 0 times, part (c) 0 times, and part (d) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

There have been no attempts to answer part (c)

There have been no attempts to answer part (d)

Problem #7

CONSIDER LOOP OF RADIUS r SURROUNDING THE CENTRAL CORE. APPLY AMPERE'S LAW.

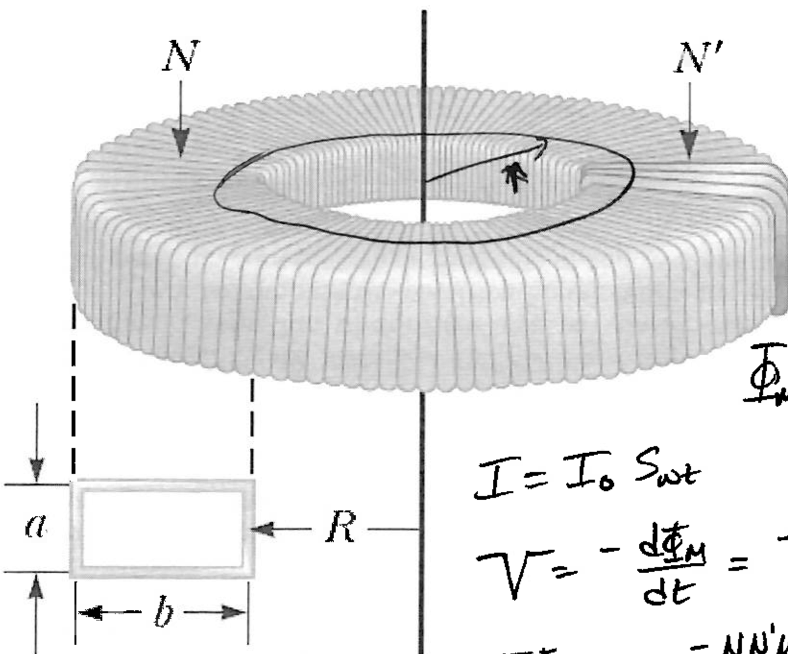
$$\oint \vec{B}\cdot d\vec{\ell} = \mu_0 I_{enc}$$

$$B\cdot 2\pi r = \mu_0 N I \qquad B(r) = \frac{\mu_0 N I}{2\pi r}$$

THEN COMPUTE MAGNETIC FLUX

$$\Phi_M = \oint B\cdot dA = \int_R^{R+b} B(r)\cdot a\,dr\,N'$$

$$\Phi_M = \frac{\mu_0 N I a N'}{2\pi}\int_R^{R+b}\frac{dr}{r} = \frac{N'\mu_0 N I a}{2\pi}\ln\left(\frac{R+b}{R}\right)$$



$$I = I_0 \sin\omega t$$

$$V = -\frac{d\Phi_M}{dt} = -\frac{NN'\mu_0 a}{2\pi}\ln\left(\frac{R+b}{R}\right)\cdot\frac{dI}{dt}$$

$$V = -\frac{NN'\mu_0 a\omega}{2\pi}\ln\left(\frac{R+b}{R}\right)I_0\cos\omega t$$

A toroid having a rectangular cross section (a = 2.10cm by b = 3.30cm) and inner radius R = 4.50cm consists of N = 539 turns of wire that carry a sinusoidal current $I = I_0\sin(\omega t)$, with I_0 = 49.0A and an angular frequency ω = 7.20rad/s. A coil that consists of N' = 21 turns of wire is wrapped around one section of the toroid as shown in above figure. Determine the magnitude of the emf induced in the coil when t = 0.860s.

$$V = \frac{-(539)(21)(4\pi\times10^{-7})(0.021)(7.2)(49.0)}{2\pi}\times\ln\left(\frac{.045+.033}{.045}\right)\cos(7.2\,(.86))$$

RADIANS!!

9.19 mV ☑ Answer the question

Submit

$$V = 0.0092\cos(354.77^\circ)$$

$$\boxed{V = 9.19\times10^{-3}\ V}$$

Attempted the problem 0 times.

There have been no attempts to answer the problem

Problem #8

An electromagnet produces a uniform magnetic field of $|\mathbf{B}| = 1.30\mathrm{T}$ over a cross-sectional area of $A = 0.210\mathrm{m}^2$. A coil with $N = 190$ turns and a total resistance of $R = 19.00\Omega$ is placed around the electromagnet. The current in the electromagnet is then smoothly reduced until it reaches zero. What is the magnitude of the induced current when the time it takes to completely reduce the magnetic field is (a) $t = 18.0\mathrm{ms}$. (b) What is the magnitude of the induced current, if instead, it takes $t = 10.0\mathrm{ms}$?

(a) 151.7 A Answer part (a)

(b) 273 A Answer part (b)

Submit

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

$$\Phi_M = NAB$$

$$V = \frac{\Delta\Phi}{dt} = \frac{NAB}{\Delta t}$$

$$I = \frac{V}{R} = \frac{NAB}{R\Delta t}$$

a) $I = \frac{(190)(.21)(1.3)}{19\,(18\times10^{-3})}$

$\boxed{I = 151.7 \text{ AMPS}}$

b) IF $\Delta t = 10$ MS $\Rightarrow$

$\boxed{I = 273 \text{ AMPS}}$