Key

UIL EMF (Voltage)

Formulas

$V = BLv$ $\qquad V = -NA\frac{\Delta B}{\Delta t}$ $\qquad V = \omega NBA$

P15. A coil of wire consists of 10 loops, each with an area of 0.0500 m^2. The plane of the coil is oriented horizontally. The coil is placed in a 1.25-T magnetic field that is oriented vertically upward. If the coil is rotated at _____ rpm, the magnitude of the maximum induced emf is 12.0 V.

A) 141
B) 155
C) 169
(D) 183
E) 197

$N = 10$
$A = .05$
$B = 1.25$
$V = 12V$

$V = \omega NBA$
$12 = \omega(10)(1.25)(.05)$
$\omega = 19.2 \frac{rad}{sec}$

$\omega = 2\pi f$
$f = \frac{\omega}{2\pi} = 3.05 \cdot 60 = 183 \frac{rev}{min}$

P15. An Air Force jet plane is flying at a speed of 304 m/s in a region where the Earth's magnetic field is almost vertical. The magnitude of the field is 5.17 x 10^{-5} T. The distance between the wing tips is 44.8 m. Find the potential difference between the wing tips.

A) 1.52 V
B) 1.32 V
C) 1.11 V
D) 0.908 V
(E) 0.704 V

$v = 304 m/s$
$B = 5.17 \times 10^{-5} T$
$L = 44.8 m$
$V = ?$

$V = BLv = (5.17 \times 10^{-5})(44.8)(304)$
$= .704 V$

P15. A coil of wire consists of 200 loops, each with an area of 0.0450 m^2. The plane of the coil is oriented horizontally. The coil is placed in a 0.853-T magnetic field that is oriented vertically upward. If the coil is rotated at 120 rpm, what is the magnitude of the peak emf induced?

A) 86.6 V
B) 89.9 V
C) 93.2 V
(D) 96.5 V
E) 99.8 V

$N = 200$
$A = .045 m^2$
$B = .853 T$
$f = 120 r/min \cdot \frac{1 min}{60 sec} = 2 rev/sec$
$V =$

$\omega = 2\pi f$
$\omega = 2\pi(2) = 4\pi \frac{rad}{sec}$

$V = \omega NBA = 96.5 V$

P15. A circular conducting loop has a radius of 3.22 cm and the plane of the loop is fixed perpendicular to a magnetic field that changed from 0.225 T to 3.69 T in 0.00345 s. Find the magnitude of the induced emf.

A) 2.11 V
B) 2.40 V
C) 2.69 V
D) 2.98 V
(E) 3.27 V

$V = -NA\frac{\Delta B}{\Delta t}$

$V = \pi(.0322)^2 \frac{3.69 - .225}{.0034}$

$= 3.27V$

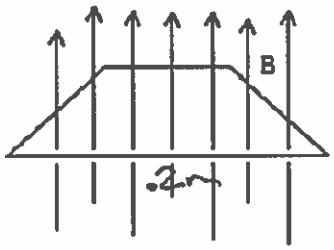
$r = .0322$

$B_0 = .225T$

$B_f = 3.69T$

$t = .00345$

P13. A square constructed from conductive copper wire is 20.0cm on a side. The resistance of the wire square is 0.400Ω. The wire square is placed in a perpendicular 0.0600 T magnetic field. If the magnetic field vanishes in a time of 5.00ms, what is the current induced in the wire loop?



A) 0.190 A
B) 0.940 A
(C) 1.20 A
D) 3.77 A
E) 6.00 A

$S = .2$

$A = (.2)^2$

$R = .4\Omega$

$B_0 = .06$ $B_f = 0$

$t = .005$

$V = -NA\frac{\Delta B}{\Delta t}$

$V = (.2)^2 \frac{.06 - 0}{.005} = .48V$

$V = IR$

$I = \frac{V}{R} = \frac{.48}{.4} = 1.2A$