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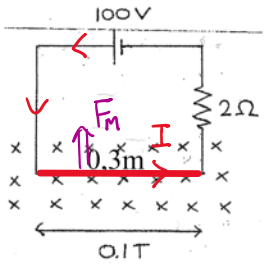
June 1, 2023 9:38 AM

Physics 12: Electromagnetism **Practice Test** **Name** Key.

Short Answers: Show all work,

1) Find the Magnetic Force (Magnitude and Direction) on the wire *[4 marks]*



$V = IR \quad 100 = I(2) \quad I = 50\,A$

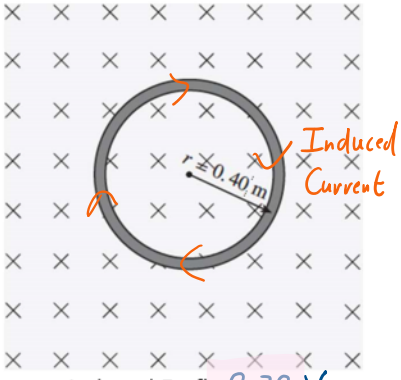
$F_M = BIl = 0.1\,T\,(50A)(0.3m) = 1.5\,N$

Dir from RHR #3a

Force) 1.5 N

Direction of Force) Up (Top of page)

2) A coil of wire containing 50 loops is lying on a flat surface in a 0.60 T magnetic field pointing directly into the surface. The magnetic field then changes to a value of 0.10 T in the opposite direction in 2.10 s. What is that average EMF induced in the coil and the direction of induced current. *[4 marks]*



(+) Into page 0.6T → out page (−) 0.1T

a) $\Delta B = -0.1 - (+0.6) = -0.7\,T$ (drop)

$\text{Area} = \pi r^2 = \pi (0.4)^2$

$\mathcal{E}_{Ind} = N\frac{\Delta\Phi}{t} = 50 \cdot \frac{(0.7T)(\pi\, 0.4^2)}{2.1\,sec} = 8.38\,V$ ($\Delta B \cdot$ Area)

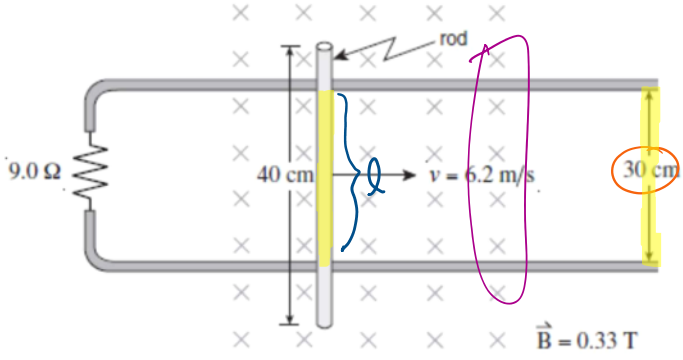
b) change : $\vec{B}$ into page ↓

coil : create $\vec{B}$ into page ⇒ I_{ind} [cw]

Induced Emf) 8.38 V

Direction of current) [CW]

4) What are the **induced Emf (Voltage)**, **magnitude and direction** of the **current** induced in the moving rod? *[5 marks]*



a) $\mathcal{E} = Blv = 0.33\,T(0.3m)(6.2)$

$\mathcal{E} = 0.6138\,V$

b) $V = IR$

$0.6138 = I(9\Omega)$

$30\,cm = 0.3\,m$

Induced E.m.f.) 0.6138 V

Induced Current) 0.0682 A

Direction) [ccw]

$V_p \quad V_s \qquad I_s$

5) An AC transformer converts 120V into 3.0V. An electronic device draws 4.5 mA from the transformer. If the secondary coil has 50 turns, what is the **number of turns, current, and power** in the primary coil? *[4 marks]*

$N_s \qquad N_p \quad I_p \quad P$

a) $\frac{N_p}{N_s} = \frac{V_p}{V_s}$

b) $\frac{I_p}{I_s} = \frac{V_s}{V_p}$ $I_p = 0.0001125\,A$

a) $\frac{N_p}{N_s} = \frac{V_p}{V_s}$

$\frac{N_p}{50} = \frac{120}{3}$ $N_p = 2000$ turns

b) $\frac{I_p}{I_s} = \frac{V_s}{V_p}$ $I_p = 0.0001125\,A$

$\frac{I_p}{0.0045} = \frac{3}{120}$

$P = I_s V_s$

$P = 0.0045\,(3)$

$P = 0.0135\,W$

Turn) 2000 turns

Current) 1.125×10^{-4} A

Power) 0.0135 W

6) When the motor in an air conditioner is first turned on, it momentarily draws 40 A. Then the current quickly drops to a steady 13.8 A. If the motor is operated on a 120 V power source, what is the **back emf** generated while the motor is running? *[4 marks]*

$\mathcal{E} = I_{max} R$ $120 = 40\,(R)$ $R = 3\,\Omega$

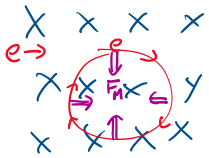
$V_{back} = \mathcal{E} - I_{min} R$

$V_{back} = 120\,V - 13.8\,A\,(3\,\Omega)$

Back Emf) 78.6 V

7) An electron travelling at 7.7×10^6 m/s enters at right angles into a uniform magnetic field. Inside the field the path of the electron has a radius of 3.5×10^{-2} m.

a) What is the magnitude of the magnetic field? *[3 marks]*



$F_m = F_c$

$QvB = \frac{mv^2}{r}$

$1.6 \times 10^{-19} B = \frac{(9.11 \times 10^{-31})(7.7 \times 10^6)}{0.035\,m}$

Magnetic field) 1.25×10^{-3} T

b) If the magnetic field is produced at the center of a solenoid by a current of 0.62 A, what is the number of (n) turns per unit length of the solenoid? *[2 marks]*

1607 turns/m ⇒ Coil density !!

$\vec{B} = \mu_0 n I = 4\pi \times 10^{-7} (n)\,0.62\,A = 1.25 \times 10^{-3}$ T

$n = 1607$ turns/m

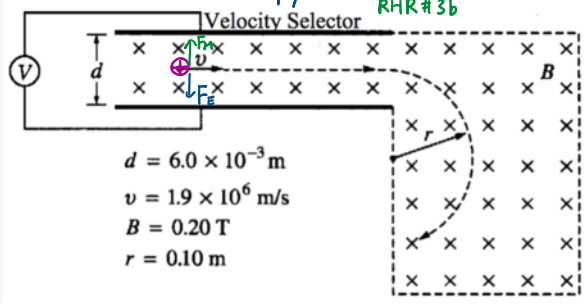
n) 1607 turns/m

8) A 4.8×10^{-1} C particle moves with constant speed **v** as it passes undeflected through a pair of parallel plates (Velocity Selector). The plates are separated by a distance **d** and a constant potential difference V is maintained between them. The particle passes into the region to the right the plates where only the magnetic field exists and follows a circular path with radius **r**. [5 marks]

⊕ → Into page $\vec{B}$] → F_M [up] RHR #3b

a) Determine the magnitude of the **potential difference V** between the plates

b) Determine the mass of the charged particle.



a) need $F_E = F_m$ $\frac{\Delta V}{d} = Qv\vec{B}$

$\frac{\Delta V}{0.006} = 1.9 \times 10^6\,m/s\,(0.2\,T)$

$\Delta V = 2280\,V$

b) $F_M = F_c$ $QvB = \frac{mv^2}{r}$

$(0.48)(0.20) = \frac{m\,(1.9 \times 10^6)}{0.1}$

$m = 5.05 \times 10^{-9}$ kg

Voltage) 2280 V

m) 5.05×10^{-9} kg