$mmf = NI$ (Unit A-T)

$B = \frac{\phi}{A}$ (Wb/m^2)

$H = \frac{B}{\mu_0 \mu_r}$ (AT/m)

$H = \frac{NI}{l}$ (AT/m)

$S = \frac{l}{A\mu_0 \mu_r}$ (AT/Wb)

$\phi = \frac{mmf}{reluctance}$

$\left[I = \frac{EMF}{Resistance} \right]$

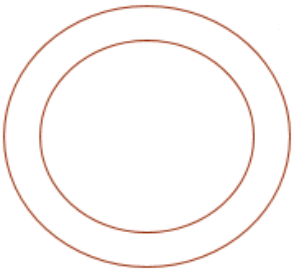
Illustration 2 - Magnetic Circuits

a) An iron ring has a circular cross- sectional area of 5 cm2 and a mean circumference of 100 cm. The ring is uniformly wound with a coil of 1000 turns. Relative permeability of iron is 800.

b) Find the current required to produce a flux of 1 mWb in the ring.

c) If a saw cut of 2 mm wide is made in the ring, find the flux produced, if the current is same as that found in **part a.**

d) Find the current required to produce the same flux as in **part a** for the cut made in the ring in **part b.**



(a)

$\phi = \frac{mmf}{S} = \frac{NI}{S}$

$$S = \frac{l}{A\,\mu_0\,\mu_r} = \frac{100 \times 10^{-2}}{5 \times 10^{-4} \times 4\pi \times 10^{-7} \times 800} = 1989436.789\ AT/Wb$$

$$\emptyset = \frac{mmf}{Reluctance} = \frac{NI}{S}\ or\ I = \frac{S\,\emptyset}{N} = \frac{1 \times 10^{-3} \times 1989436.789}{1000} = 1.9894\ A$$

(b)

$$S_i = \frac{l_i}{A_i\,\mu_0\,\mu_r} = \frac{(100 \times 10^{-2}) - (2 \times 10^{-3})}{5 \times 10^{-4} \times 4\pi \times 10^{-7} \times 800} = 1985457.915\ AT/Wb$$

$$S_g = \frac{l_g}{A_g\,\mu_0\,\mu_r} = \frac{(2 \times 10^{-3})}{5 \times 10^{-4} \times 4\pi \times 10^{-7} \times 1} = 3183098.862\ AT/Wb$$

$$S_T = S_i + S_g = 5168556.777\ AT/Wb$$

$$\emptyset = \frac{mmf}{Reluctance} = \frac{NI}{S_T} = \frac{1000 \times 1.9894}{5168556.777} = 0.3849\ mWb$$

c)

$$\emptyset = \frac{mmf}{Reluctance} = \frac{NI}{S_T}\ or\ I = \frac{S\,\emptyset}{N} = \frac{1 \times 10^{-3} \times 5168556.777}{1000} = 5.1685\ A$$