8 July

3. $n = 300$

$i = 0.5 A$

$l = 0.5 m$

$r = 0.1 cm$

$\frac{l}{r} = \frac{0.5}{0.1 \times 10^{-2}} = 100 \qquad l >> r$

$B = \mu_0 n i = 4\pi \times 10^{-7} \times 300 \times 5$

$= 20 \times 800 \times \pi \times 10^{-7}$

$= 1.88 \times 10^{-3} T$

4. $B = \frac{\mu_0 N I}{l}$

$2.25 \times 10^{-3} = \frac{4\pi \times 10^{-7} \times 500 \times I}{0.5}$

$I = \frac{0.5 \times 2.25 \times 10^{-3}}{4\pi \times 10^{-7} \times 500}$

$I = 1.79 \simeq 1.8 A$

1. According to Ampere's circuital law the line integral of magnetic field induction along a closed curve is equal to total current passing through surface enclosed by the closed curve times the permeability of medium

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

Magnetic field inside a solenoid

Consider a following solenoid with no of turns per unit length as n, current I. Consider a rectangular amperian loop ABCD (AB = l)

$$\oint \vec{B} \cdot \vec{dl} = \int_{AB} B\, dl = Bl$$

Using A C L,

$$\oint \vec{B} \cdot \vec{dl} = \mu_0 I$$

$$Bl = \mu_0 n l I$$

$$B = \mu_0 n I$$

2.

c) The magnetic field is made strong by

i) Passing large current
ii) using laminated coil of soft iron

b) Magnetic lines do not exist outside the body of a toroid. Toroid is closed and solenoid is open on both sides. Magnetic field is uniform inside a toroid whereas for a solenoid it is different at two ends and centre.

a) ~~$\oint$~~ $\oint \vec{B} \cdot \vec{dl} = \mu_0$

$B = 0$

Magnetic field outside solenoid is 0

field inside Solenoid

$$\oint \vec{B} \cdot \vec{dl} = \int B \cdot dl + \int B \, dl + \int B \cdot dl + \int B \cdot dl \longrightarrow i)$$

$$\int_{QP} B \cdot dl = \int B \cdot dl = \int B \, dl \cos 90 = 0$$

$$\oint B \cdot dl = \int B \cdot dl = Bl$$

Now using Ampere's law

$$\oint \vec{B} \cdot \vec{dl} = \mu_0 I$$

$$Bl = \mu_0 (nlI)$$

$$B = \mu_0 nI$$