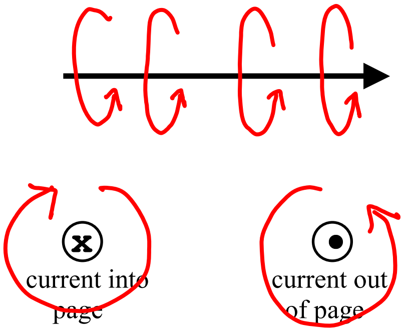
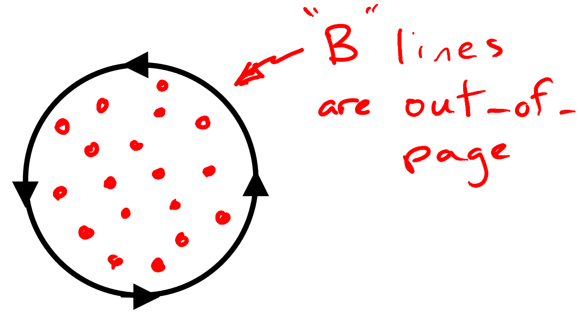
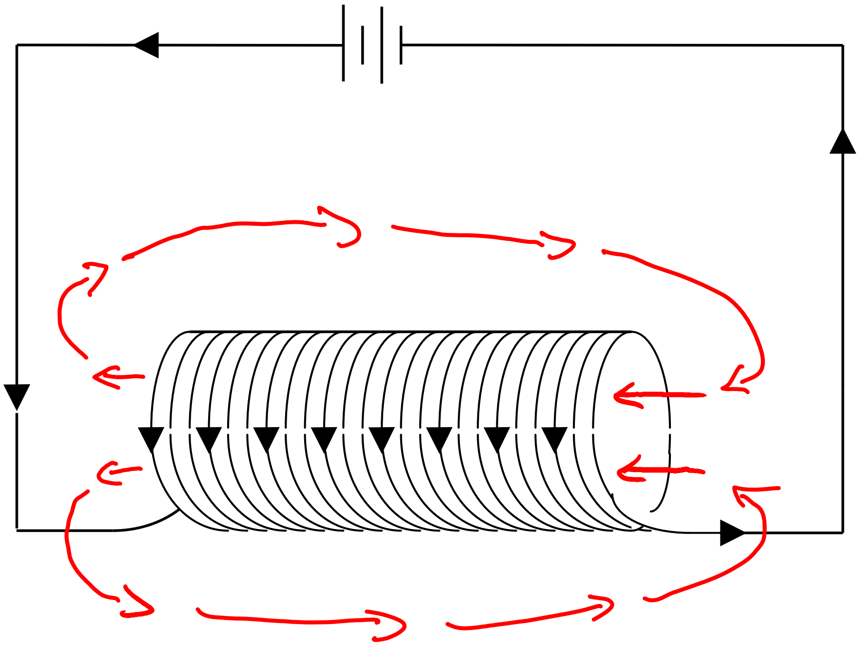
Example #1: Draw magnetic field lines for the following conventional current directions:





Indicate the direction of **B** *inside* the loop

Example #2: Using the Right-Hand-Rule, determine and draw the shape of the magnetic field both inside and around the solenoid in the above diagram.



→ inside solenoid, field lines point to left; outside they move around to the right

→ note: left side represents <u>north</u> pole of solenoid.

Example #3: A solenoid 15 cm long has 600 turns and carries a current of 5.0 A. What is the magnetic field strength inside this coil?

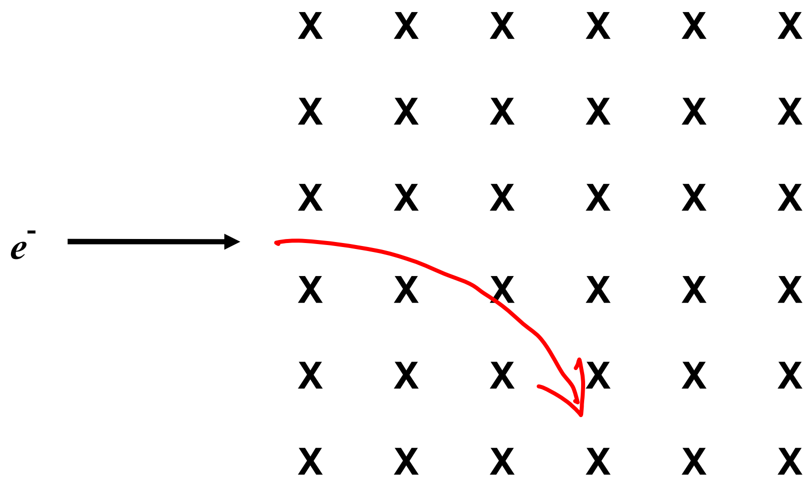
$$B = \mu_0 \frac{N}{l} I$$

$$= \frac{4\pi \times 10^{-7} (600)(5.0)}{0.15}$$

← note

$$\boxed{B = 0.025\ T}$$

Example #4: An electron travelling at 2.5 x 10^7 m/s enters a magnetic field of strength 4.1 x 10^{-3} T as shown below. Note that the field lines, represented by 'X', are into the page, and are perpendicular to the electron's path.



a) **What is the magnetic force that acts on the electron once it enters the field?**

b) **Use the left-hand rule (remember, this is a <u>negative</u> charge) to sketch the path of the electron in the field.**

$$F_{mag} = qvB$$

$$= (1.6 \times 10^{-19})(2.5 \times 10^{7})(4.1 \times 10^{-3})$$

$$\boxed{F_{mag} = 1.6 \times 10^{-14}\ N}$$

Example #5: Using the information from example 4, what is the radius of the circular path taken by the electron once it enters the field?

$$F_c = F_{mag}$$

$$\frac{mv^{\not 2}}{r} = q\not v B$$

$$r = \frac{mv}{qB}$$

$$= \frac{9.11\times10^{-31}(2.5\times10^{7})}{1.6\times10^{-19}(4.1\times10^{-3})}$$

$$\boxed{r = 0.035\ m}$$

Example # 6: A proton travels undeflected at 1.1×10^5 m/s through crossed electric and magnetic fields. If B = 0.50 T, determine the electric field strength E.

- if undeflected, $F_{net} = 0$

so $F_E = F_{mag}$

$$\cancel{q}E = \cancel{q}vB$$

$$E = (1.1 \times 10^5)(0.50)$$

$$\boxed{E = 5.5 \times 10^4 \text{ N/C}}$$

Example #7: Carbon atoms of atomic mass 12.0 a.m.u. are mixed with atoms of another unknown material. In a mass spectrometer, the C-12 atoms follow a path of radius 22.4 cm, while the unknown atoms produce a 26.2-cm radius path. Assuming <u>identical</u> charges, what is the atomic mass of the unknown material?

$m \propto r$ (see notes)

so $m_{unknown} = 12\left[\frac{26.2}{22.4}\right]$

$= \boxed{14 \text{ a.m.u}}$

→ this is the mass of the atomic isotope carbon-14.

Example # 8: The magnetic field strength inside a solenoid is 0.025 T. If a 3.2-cm long conducting strip positioned at right angles to the magnetic field inside the solenoid experiences a force of 5.9 x 10^{-4} N, what is the current in the conducting strip?

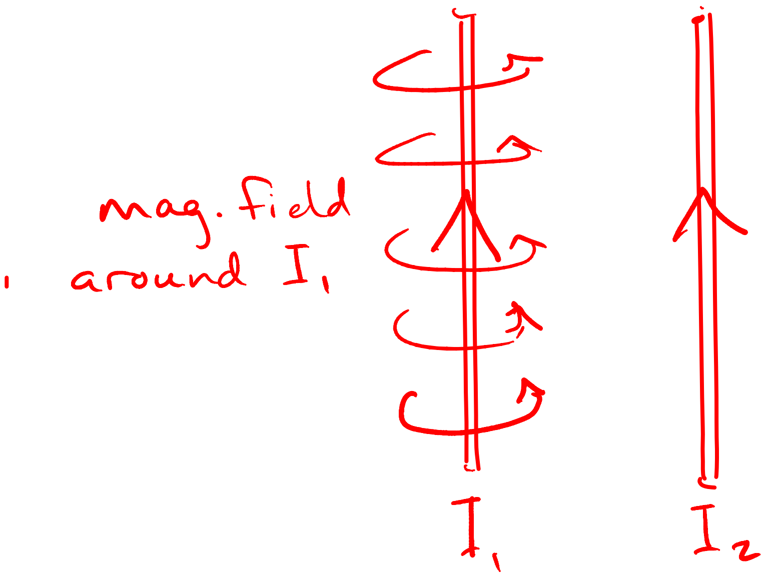
$$F_{mag} = BIl$$

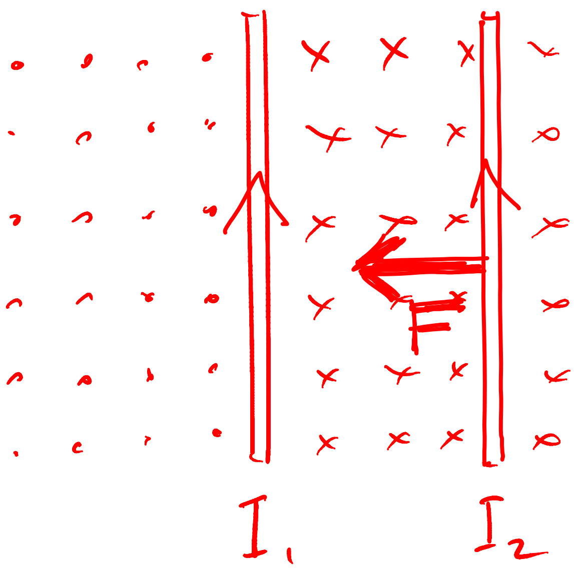
$$5.9 \times 10^{-4} = (.025) I (.032)$$

← note

$$I = 0.74 \text{ A}$$

Example # 9: Prove, using both types of the RHR, that two parallel wires carrying current in the *same* direction are attracted to each other.

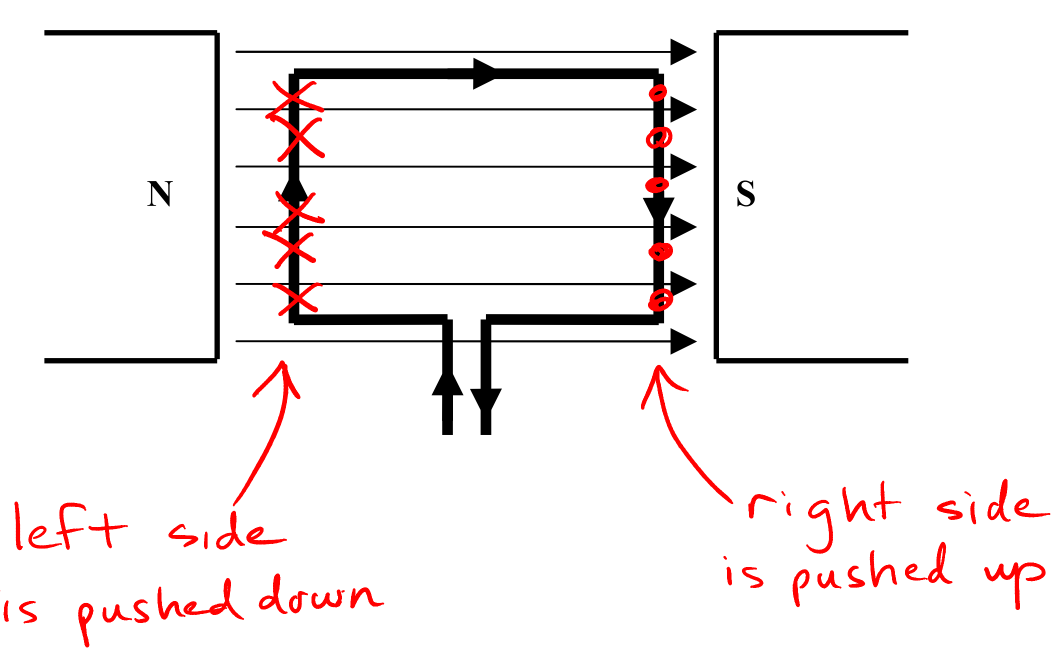




→ field due to I_1 causes a force to pull I_2 to the left (attracted to I_1)

→ could also show I_2 pulling I_1 to the right (also attracted)

Example #10: Determine the direction of rotation for the loop in the above diagram.



→ notice that only the portions of the loop that are perpendicular to the field lines are affected by a magnetic force when current flows in the loop.