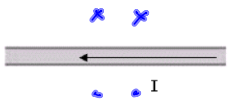
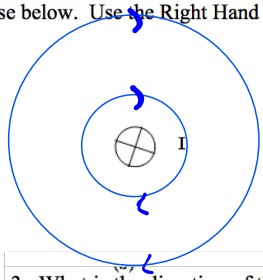
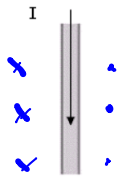
1. Draw the magnetic field around the wire in each case below. Use the Right Hand Rule for Fields to determine its direction.



(a)

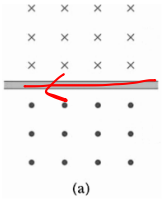


(b)

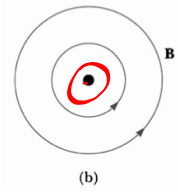


(c)

2. The magnetic field produced by the current is shown in each case. Use the Right Hand Rule for Fields to determine the direction of the current flow in each wire shown below.

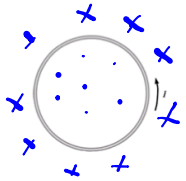


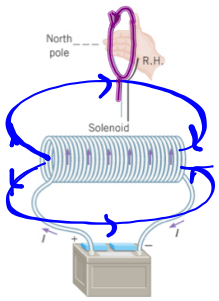
(a)



(b)

3. What is the direction of the magnetic field inside the wire loop shown below? The Solenoid?





**Eqn $B = \frac{\mu_0 I}{2\pi r}$

$B = N\frac{\mu_0 I}{2r}$

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

$\frac{1}{\sqrt{\varepsilon_0 \mu_0}} = c$

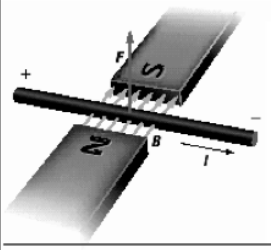
Force on a Wire

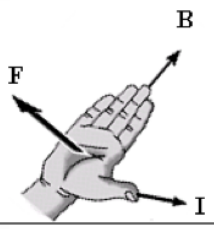
If a wire with current flowing through it is placed in an external magnetic field, it will experience a force. Why?

Two magnetic fields – around wire and from external magnet – will either attract or repel

Right Hand Rule: Magnetic Force on a Wire

The direction of the force exerted on a wire bearing current when placed in an external magnetic field can be determined by a **Flat Hand** right hand rule.





Flat Hand: thumb ⊥ fingers

Fingers: $\vec{B}$

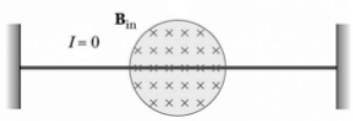
Thumb: → I

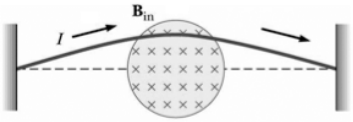
Palm: → $\vec{F}$

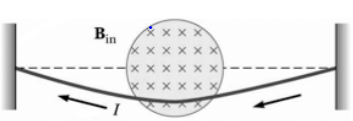
Maximum force occurs when: $B \perp l$

No force occurs when: $B \parallel l$

Use the right hand rule for forces to confirm the direction of the force in each case.







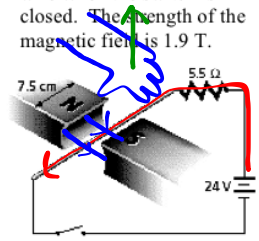
Magnitude of the force on a wire:

$\vec{F} = (\vec{B} \times \vec{\ell}) \cdot I$

$= B \ell \sin\theta \cdot I$

Variable:	$\vec{B}$	I	$\vec{\ell}$	$\vec{F}_B$
Quantity:	mag Field	current	length	mag. Force
Units:	$[\frac{N}{A \cdot m}]\cdot[T]$	[A]	[m]	[N]
Type:	Vector	scalar	Vector	Vector

1. Find the magnitude and direction of the force on the wire when the switch is closed. The strength of the magnetic field is 1.9 T.



$F = BI\ell$

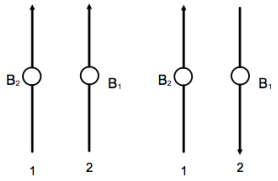
$= B\left(\frac{V}{R}\right)\ell$

$= 1.9\,T\left(\frac{24\,V}{5.5\,\Omega}\right).075\,m$

$= .6\,N$ up

Magnetic Force between Two Wires

2. Why do two wires carrying current attract or repel each other?



General Rule:

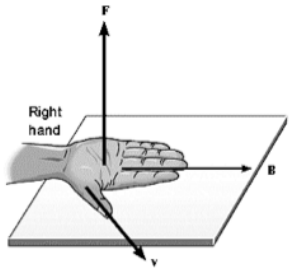
5

Magnetic Force on a Moving Charged Particle

Why is there a magnetic force on a charged particle as it moves through a magnetic field?

Moving charged particle creates its own magnetic field – two magnetic fields interact

Right Hand Rule: Magnetic Force on a Charged Particle



Flat Hand: **Fingers:**

Right Hand: **Thumb:**

Left Hand: **Palm:**

Maximum force occurs when:

No force occurs when:

Find the direction of the magnetic force on each particle below as each enters the magnetic field shown.