

CONCEPT: FORCE ON CURRENT-CARRYING WIRES

- Charges can move in space, OR inside a WIRE → CURRENT

CHARGES IN SPACE	CURRENT-CARRYING WIRES
- A <u>moving</u> Charge PRODUCES a NEW B-Field → $B =$ - A Charge <u>moving</u> in an EXISTING Field FEELS a Force → $F =$	- A current-carrying wire PRODUCES a NEW B-Field → $B =$ - A wire in an EXISTING Field FEELS a Force (if $i \neq 0$) → $F =$

- Directions are given by the RIGHT HAND RULE Negative charges → LHR Currents → ALWAYS RHR

- The Magnetic Force on a current-carrying wire will cause it to bend slightly:

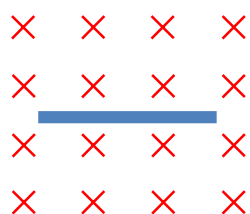
(i) current up:



(b) current down:

EXAMPLE: A 2-meter-long wire is passed through a constant magnetic field, as shown below:

- (a) If the wire experiences a force of 3 N when it has a current of 4 A, what is the strength of the field?
- (b) If the wire experiences a downward force, what must the direction of the current be?



EXAMPLE: FORCE ON CURRENT-CARRYING WIRE AT AN ANGLE

A 2-m long wire is immersed in a 3 T magnetic field that is directed in the negative y axis. What is the magnitude of the magnetic force on the wire if it has 4 A flowing through it and it is directed:

- (a) in the negative y axis (b) in the positive x axis (c) in a direction that makes 53° with the +y axis

PRACTICE: CURRENT ON WIRE AT AN ANGLE

A 5-m current-carrying wire (red line) is ran through a 4 T magnetic field (blue lines), as shown. The angle shown is 30° . What must the magnitude and direction of the current in the wire be when it feels a 3 N force directed into the page?

