**Practice for 20.1 - Right Hand Rules**

**1.** These are vector cross product questions. The "X" in the middle means cross product. Your right hand **index finger** goes in the direction of the **first vector**, your **middle finger** in the direction of the **second vector**, and your **thumb** is the **resultant vector** or answer. (Whilst you are making the Physics gang sign)

"x" = into the page

"." = out of the page

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| **(down the page)**  X  x | **(up the page)**  X  **.** | **(out of the page)**  X | **(left)**  X  **.** |
| **(right)**  X  x | **(down the page)**  X  **.** | **(up the page)**  X  x | **(up the page)**  X  **.** |
| **(into the page)**  X | **(right)**  X  x | **(into the page)**  X | **(up the page)**  X  **.** |
| **(out of the page)**  X | **(down the page)**  X  **.** | **(left)**  X  **.** | **(into the page)**  X |
| **(out of the page)**  X | **(left)**  X  **.** | **(left)**  X  **.** | **(into the page)**  X |

**2.** These are for the magnetic field around a wire. You wrap the fingers of your right hand around the wire with your **thumb** in the direction of the **current**. Your **fingers** wrap in the direction that the **magnetic field (B)** encircles the wire. So in these, where it says "B?" I want to know the direction of the B field there on that side of the wire. (into (x) or out of (.) the page) Where I give you the B field, I want to know which way the current would go to effect those fields.

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| **(into the page)**  B?  I | **(into the page)**  I  B? | **(current flows →)**  B x x x x x x x  B . . . . . . .  I? | **(left side into the page, right side, out of the page)**  B?  B? |
| **(into the page)**  B?  I | **(out of the page)**  B?  I | **(current flows →)**  B x x x x x x x  B . . . . . . .  I? | **(left side into, right out of page)**  B?  B? |
| **(into the page)**  I  B? | **(out of the page)**  B?  I | **(current flows ←)**  B . . . . . . .  B x x x x x x x  I? | **(below the wire into the page, above, out of)**  I  B?  B? |
| **(out of the page)**  B?  I | **(into the page)**  B?  I | **(current flows ↑)**  B  .  .  .  .  .  B  x  x  x  x  x  I? | **(above the wire into, below the wire out of the page)**  B?  B? |
| **(out of the page)**  I  B? | **(out of the page)**  I  B? | **(current flows ↓)**  B  .  .  .  .  .  B  x  x  x  x  x  I? | **(right side into, left side, out of the page)**  I  B?  B? |

**3.** These are for predicting the location of the North Pole of an electromagnet or loop of wire. You wrap the **fingers** of your right hand in the **direction of the current** in the loop or solenoid, and your **thumb** is the **North Pole**.

"x" = into the page

"." = out of the page

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| **Which way does the north pole point?(.)**  I | **Which way does the north pole point? (x)**  I | **Which way does the north pole point? (←)**  **(Current flows up on Front of coil)** | **Which way does the current flow on the front side of this coil? (←)**  N  S |
| **Which way does the north pole point? (.)**  I | **Which way does the north pole point? (x)**  I | **Which way does the north pole point? (↑)**  **(Current flow L to R on Front of coil)** | **Which way does the current flow on the front side of this coil? (↓)**  N  S |
| **Which way does the north pole point? (x)**  I | **Which way does the north pole point? (.)**  I | **Which way does the north pole point? (↑)**  **(Current flow L to R on Front of coil)** | **Which way does the current flow on the front side of this coil? (↑)**  S  N |
| **Which way does the north pole point? (x)**  I | **Which way does the north pole point? (.)**  I | **Which way does the north pole point? (→)**  **(Current flows down on Front of coil)** | **Which way does the current flow on the front side of this coil? (→)**  S  N |
| **Which way does the north pole point? (x)**  I | **Which way does the north pole point? (.)**  I | **Which way does the north pole point? (↓)**  **(Current flow R to L on Front of coil)** | **Which way does the current flow on the front side of this coil? (↑)**  N  S |

**4.** This is the right hand rule for the force on a wire. Your **index finger** goes in the direction of the **current**, your **middle finger** goes in the direction of the **B field**, and your **thumb** is in the direction of the **force on the wire**. (Assuming you are making the Physics gang sign)

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| **F ? (←)**  B:  x x x x x x x  x x x x x x x  x x x x x x x  x x x x x x x  I | **F ? (.)**  B:  I | **B ? (That causes the force)**  F = **.** (out of the page)  I  **(↓)** | **I ? (↓)**  F  B:  . . . . . . .  . . . . . . .  . . . . . . .  . . . . . . . |
| **F ? (→)**  B:  . . . . . . .  . . . . . . .  . . . . . . .  . . . . . . .  I | **F ? (x)**  B:  I | **B ? (That causes the force)**  I  F = **.** (out of the page)  **(←)** | **I ? (.)**  B  F |
| **F ? (x)**  I  B: | **F ? (.)**  B:  I | **B ? (That causes the force)**  F  I  **(.)** | **I ? (x)**  B  F |
| **F ? (.)**  B:  I | **F ? (↑)**  B:  . . . . . . .  . . . . . . .  . . . . . . .  . . . . . . .  I | **B ? (That causes the force)**  I  F  **(.)** | **I ? (↓)**  B:  x x x x x x x  x x x x x x x  x x x x x x x  x x x x x x x  F |
| **F ? (.)**  B:  I | **F ? (↑)**  I  B:  x x x x x x x  x x x x x x x  x x x x x x x  x x x x x x x | **B ? (That causes the force)**  F  I  **(.)** | **I ? ( ←)**  F  B:  . . . . . . .  . . . . . . .  . . . . . . .  . . . . . . . |

**5.** This is the right hand rule for particles. Your **index** **finger** goes in the **direction the charge is moving**, your **middle** **finger** goes in the direction of the **B field**, and your **thumb** is in the direction of the **force** on the particle. **Remember that the force will be opposite this for a negative (-) charge.**

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| **Which way is the force on the moving particle? (↑)**  B:  x x x x x x x  x x x x x x x  x x x x x x x  x x x x x x x | **Which way is the force on the moving particle? (.)**  B | **Which way must a proton move to experience a northerly force in a vertically upward magnetic field? (w)**  N  W E  S | **An electron moving south experiences a force to the west. B is what way?**  N  W E  S  **(vertically downward or x)** |
| **Which way is the force on the moving particle? (←)**  B:  . . . . . . .  . . . . . . .  . . . . . . .  . . . . . . . | **Which way is the force on the moving particle? (↓)**  B:  . . . . . . .  . . . . . . .  . . . . . . .  . . . . . . . | **Which way must a proton move to experience a vertically downward force in an easterly magnetic field? (n)**  N  W E  S | **An electron moving east experiences a force to the north. B is what way?**  N  W E  S  **(vertically upward or .)** |
| **Which way is the force on the moving particle? (x)**  B: | **Which way is the force on the moving particle? (→)**  B:  . . . . . . .  . . . . . . .  . . . . . . .  . . . . . . . | **Which way must a proton move to experience a southerly force in a vertically downward magnetic field? (w)**  N  W E  S | **An electron moving south experiences a force vertically downward. B is what way? (e)**  N  W E  S |
| **Which way is the force on the moving particle? (.)**  B: | **Which way is the force on the moving particle? (x)**  B | **Which way must a proton move to experience a easterly force in a northerly magnetic field? (vertically downward or x)**  N  W E  S | **An electron moving vertically upward experiences a force to the north. B is what way? (w)**  N  W E  S |
| **Which way is the force on the moving particle? (↑)**  B:  . . . . . . .  . . . . . . .  . . . . . . .  . . . . . . . | **Which way is the force on the moving particle?(→)**  B:  x x x x x x x  x x x x x x x  x x x x x x x  x x x x x x x | **Which way must a proton move to experience a vertically upward force in a northerly magnetic field? (e)**  N  W E  S | **An electron moving east experiences a force to the vertically downward. B is what way? (n)**  N  W E  S |