

First Name: _____

Last Name: _____

L13 - Worksheet - Motor Effect on a Wire

Textbook Questions

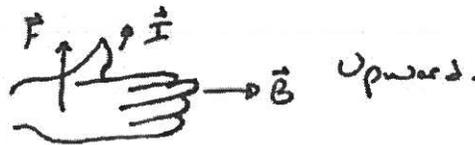
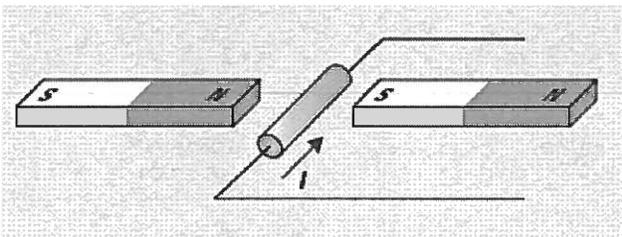
Pg 605 #1: A 0.500-m length of conducting wire carrying a current of 10.0 A is perpendicular to an external magnetic field of magnitude 0.200 T. Determine the magnetic force on this wire.

$$\begin{aligned}
 l_{\perp} &= 0.500 \text{ m} & |\vec{F}_m| &= I l_{\perp} |\vec{B}| \\
 I &= 10.0 \text{ A} & &= (10.0 \text{ A})(0.500 \text{ m})(0.200 \text{ T}) \\
 |\vec{B}| &= 0.200 \text{ T} & &= 1.00 \text{ N} \\
 |\vec{F}_m| &= ?
 \end{aligned}$$

Pg 605 #2: A thin conducting wire 0.75 m long has a mass of 0.060 kg. What is the minimum current required in the wire to make it "float" in a magnetic field of magnitude 0.15 T?

$$\begin{aligned}
 l_{\perp} &= 0.75 \text{ m} & |\vec{F}_m| &= |\vec{F}_g| \\
 m &= 0.060 \text{ kg} & I l_{\perp} |\vec{B}| &= mg \\
 I &= ? & I(0.75 \text{ m})(0.15 \text{ T}) &= (0.060 \text{ kg})(9.81 \text{ m/s}^2) \\
 |\vec{B}| &= 0.15 \text{ T} & I &= 5.232 \text{ A}
 \end{aligned}$$

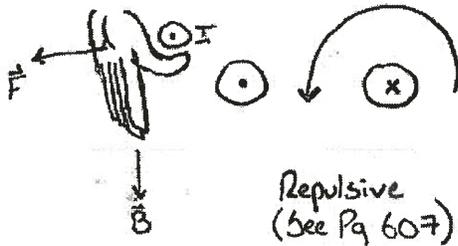
Pg 613 #8: A wire lying perpendicular to an external magnetic field carries a current in the direction shown in the diagram below. In what direction will the wire move due to the resulting magnetic force?



Pg 613 #9: A battery supplies a current of 5.20 mA to a circuit. Determine the quantity of charge that flows through the circuit in 2.00s.

$$\begin{aligned}
 I &= 5.20 \times 10^{-3} \text{ A} & I &= \frac{q}{t} & 5.20 \times 10^{-3} \text{ A} &= \frac{q}{2.00 \text{ s}} \\
 t &= 2.00 \text{ s} & q &= 1.04 \times 10^{-2} \text{ C}
 \end{aligned}$$

Pg 613 #10: Two conducting wires are parallel to each other carrying currents in opposite directions. Using the appropriate hand rule, determine whether the wires will attract or repel each other.



Pg 613 #11: A wire 50 cm long and carrying a current of 0.56 A is perpendicular to an external magnetic field of 0.30 T. Determine the magnitude of the magnetic force on the wire.

$$\begin{aligned}
 L &= 0.50 \text{ m} & |F_m| &= I L B \\
 I &= 0.56 \text{ A} & &= (0.56 \text{ A})(0.50 \text{ m})(0.30 \text{ T}) \\
 |B| &= 0.30 \text{ T} & &= 8.4 \times 10^{-2} \text{ N} \\
 |F_m| &=? & &
 \end{aligned}$$

Diploma Worksheet Questions – Motor Effect (Basic Definitions)

Q259: Electric current is a measure of the

- a. Rate at which charge passes a point
- b. Force that moves a charge past a point
- c. Energy required to move a charge past a point
- d. Resistance to the movement of a charge past a point

$$I = \frac{q}{t}$$

Q263: If the beam of high-speed protons produced by a cyclotron is equivalent to a current of 3.2×10^{-3} A, the number of protons that will leave the cyclotron each second is

- a. 2.0×10^{16}
- b. 6.3×10^{18}
- c. 2.0×10^{21}
- d. 5.1×10^{22}

$$\begin{aligned}
 I &= \frac{q}{t} \\
 3.2 \times 10^{-3} &= \frac{q}{1 \text{ s}} \\
 q &= 3.2 \times 10^{-3} \text{ C} \div 1.60 \times 10^{-19} \text{ C/e} \rightarrow 2.0 \times 10^{16} \text{ e}
 \end{aligned}$$

Q268: A current of 0.403 A flows for 3.04 min. The quantity of charge transferred is ____ C.

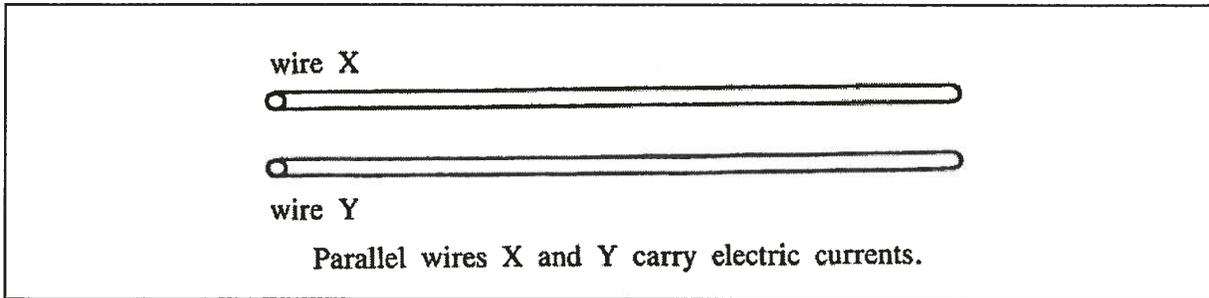
(Record your three digit answer in the Numerical Response boxes below)

7 3 . 5

$$\begin{aligned}
 I &= \frac{q}{t} \\
 0.403 \text{ A} &= \frac{q}{182.4 \text{ s}} \\
 q &= 73.5072 \text{ C}
 \end{aligned}$$

Diploma Worksheet Questions – Motor Effect (Moving Point Charge)

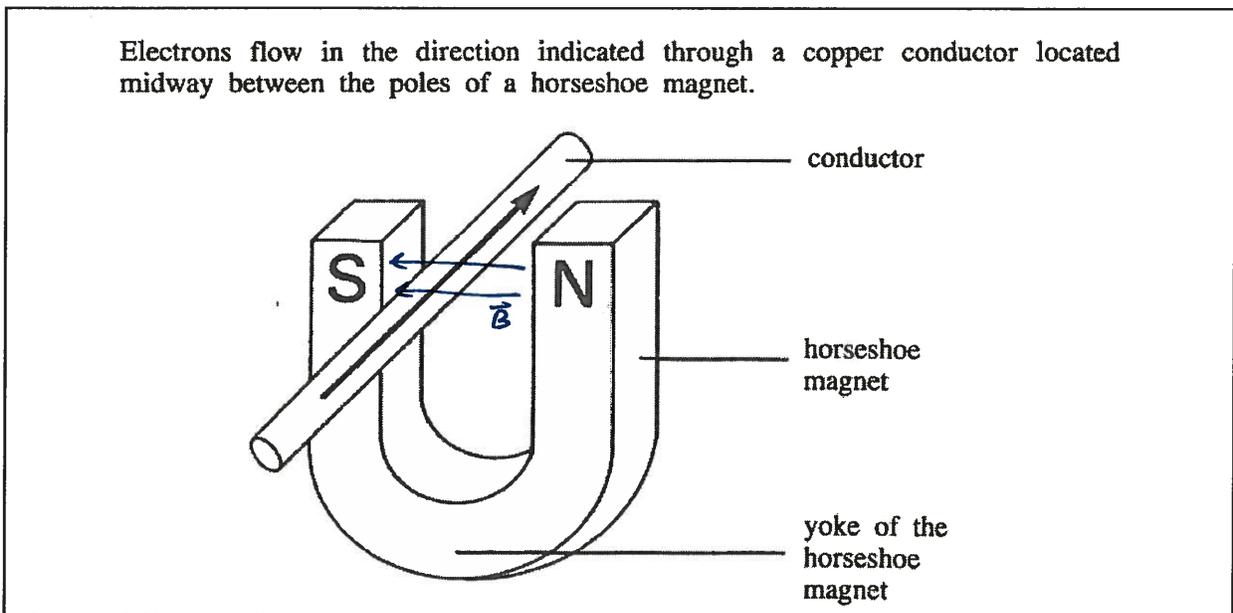
Use the following information to answer Q302:



Q302: If the direction of the current in wire X is reversed, then

- a. The current in wire Y would be reversed
 - b. Only the magnetic force on wire X would be reversed
 - c. Only the magnetic force on wire Y would be reversed
 - d. The magnetic forces on both wires X and Y would be reversed
- Both in same direction → Attractive*
Opposite directions → Repulsive

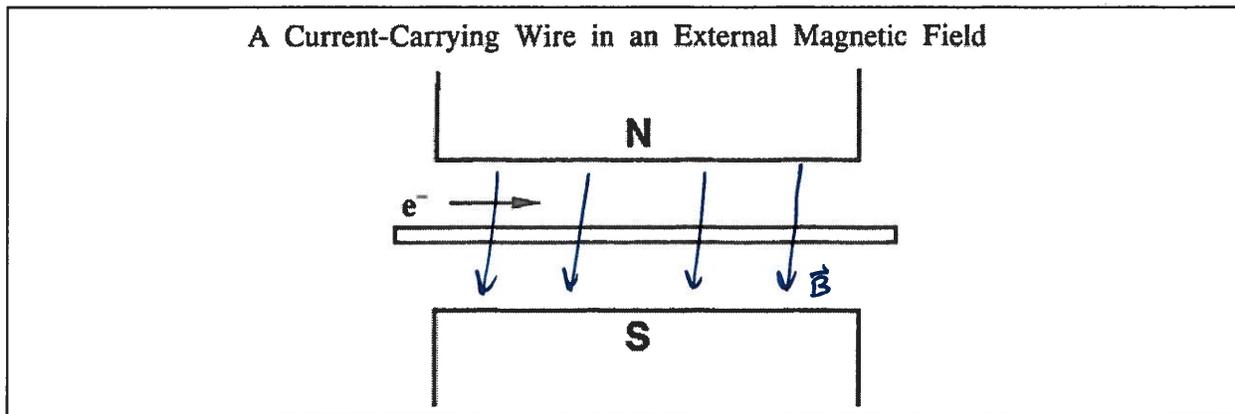
Use the following information to answer Q303:



Q303: If the conductor is free to move, it will be forces

- a. Toward the S pole of the magnet
- b. Toward the N pole of the magnet
- c. Downward, toward the yoke of the magnet
- d. Upward, away from both poles of the magnet

Use the following information to answer Q304:



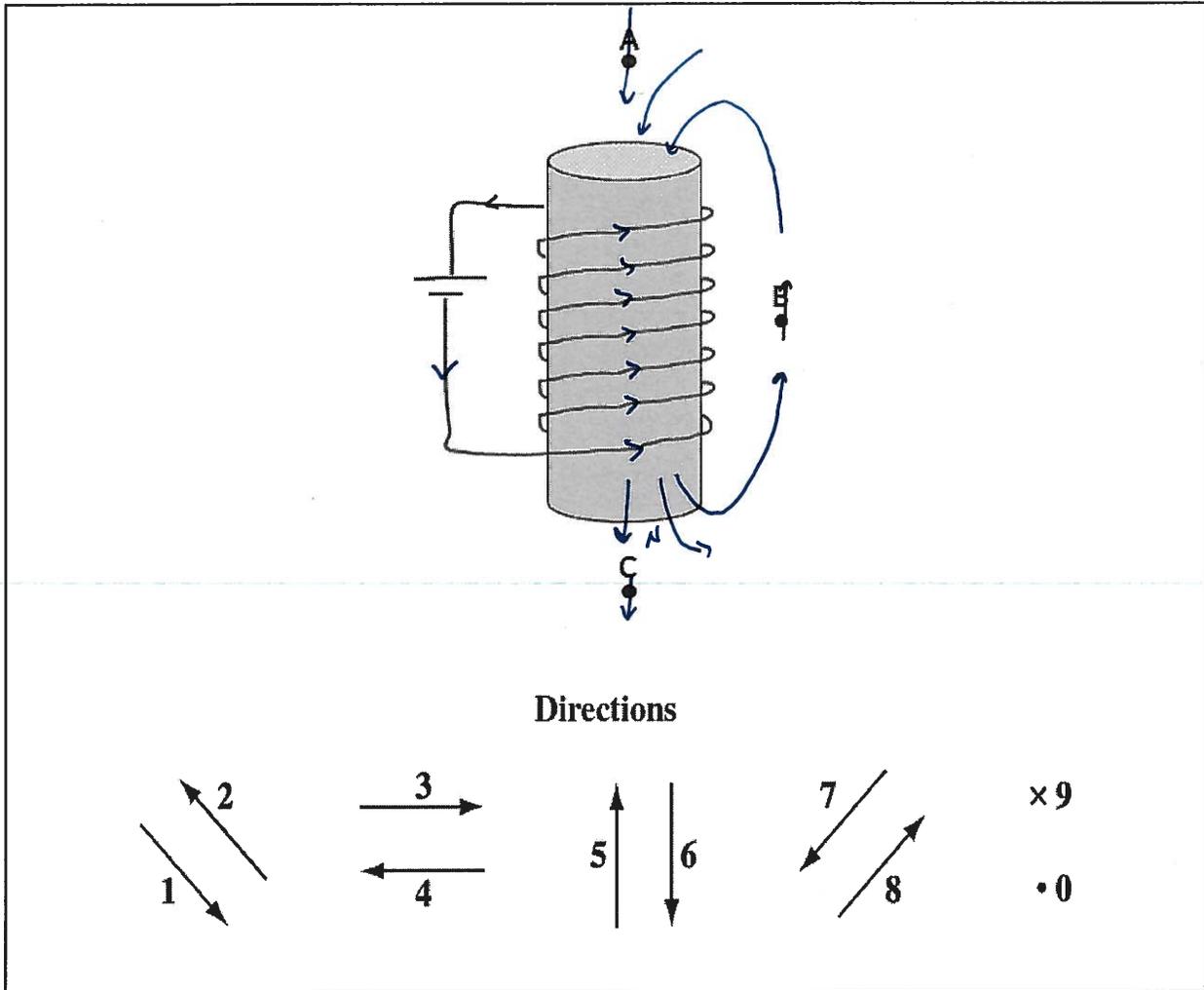
Q304: The part of the wire in the magnetic field is 10.0 cm long and carries a current of 10.0 A. If the strength of the magnetic field is 0.050 T, then the resulting force on the wire is

- a. 0.050 N out of the page
- b. 5.0 N out of the page
- c. 0.050 N into the page
- d. 5.0 N into the page

$$\begin{aligned}
 F_m &= ILB \\
 &= (10.0)(0.10)(0.05) \\
 &= 0.05\text{ N}
 \end{aligned}$$

Challenge Questions

Use the following information to answer Q1:



Q1: The directions of magnetic field at various points can be described using the numbers given above.

Direction: 6

Force: Magnetic field
at Point A

5

Magnetic field
at Point B

6

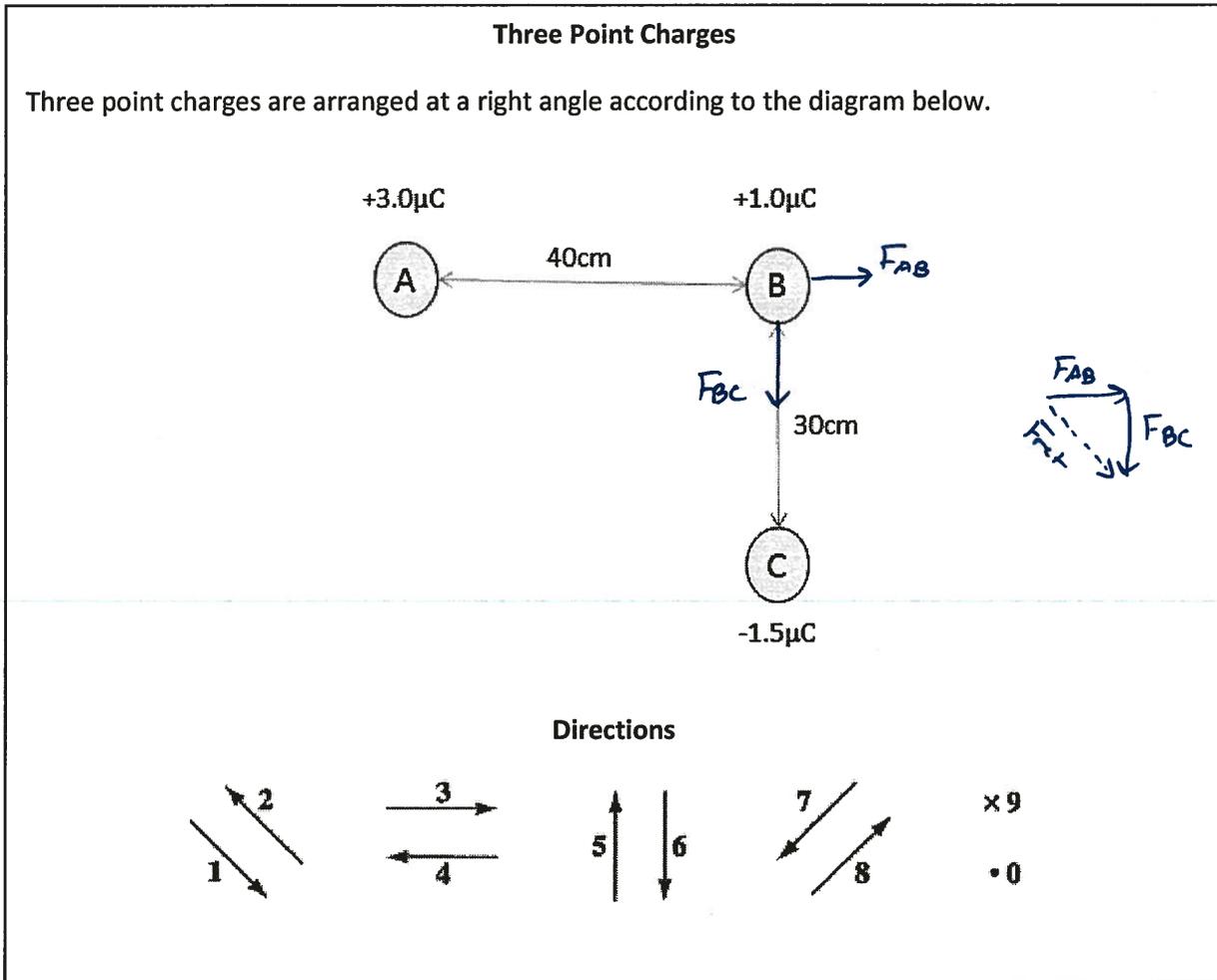
Magnetic field
at Point C

(Record your three digit answer in the Numerical Response boxes below)

6	5	6	
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Cumulative Review from Previous Units

Use the following information to answer Q1:



Q1: Use the vector directions above to fill in the blanks below.

Direction:	<u>3</u>	<u>6</u>	<u>1</u>
Description:	Direction of Force acting on Charge B due to Charge A	Direction of Force acting on Charge B due to Charge C	Direction of Net Force acting on Charge B

(Record your three-digit answer in the Numerical Response boxes below)

3	6	1	
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