

Lecture 19

Questions

T.O.C.

QUESTIONS

PAGE

1: 3

2: 6

3: 9

ANSWERS

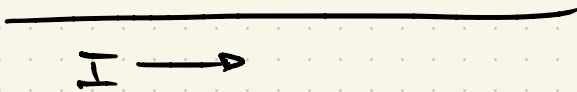
1: 11

2: 16

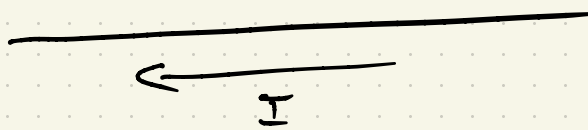
3: 20

Q1a) DRAW THE \vec{B} FIELD
GENERATED BY THE
CURRENT-CARRYING WIRE:

i)



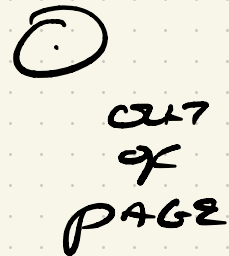
ii)



iii)



iv)



Q1b)

2

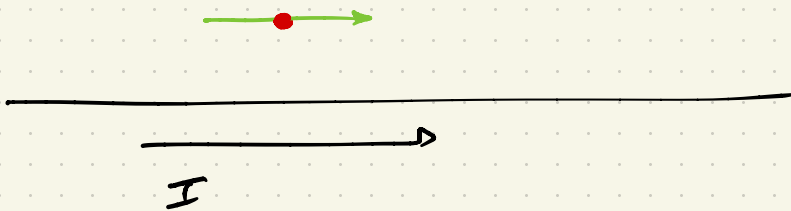
DRAW THE FORCE ^{VECTOR} ON THE CHARGED PARTICLE DUE TO THE CURRENT CARRYING WIRE(S).

HAVE TO APPLY BOTH RIGHT HAND RULES! WATCH OUT FOR $g < 0$!

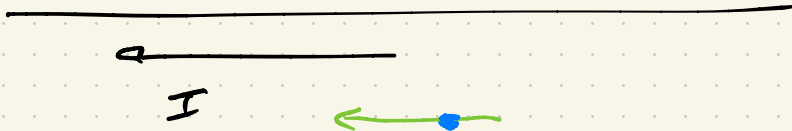
KEY

- POSITIVE CHARGE
- NEGATIVE CHARGE
- PARTICLE VELOCITY

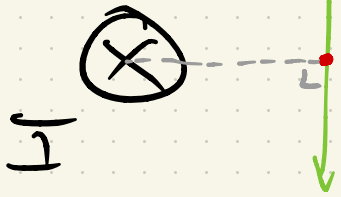
i)



ii)



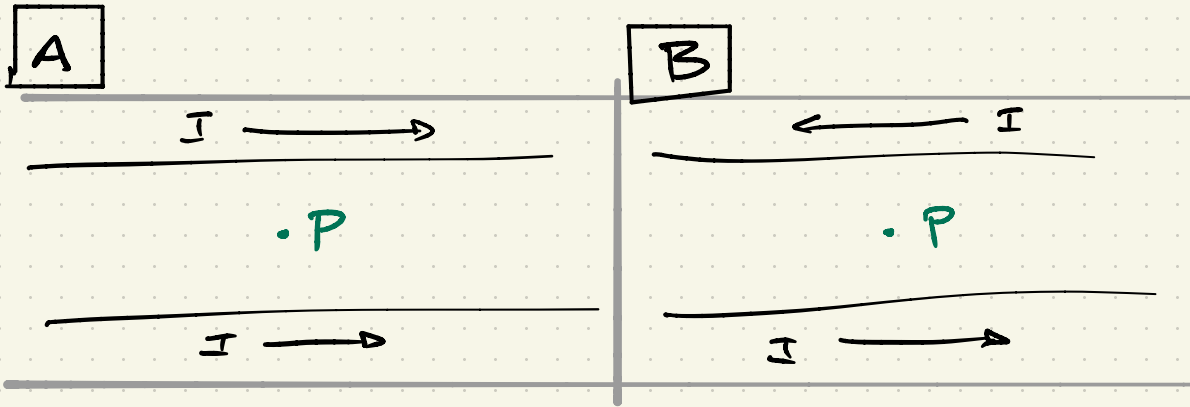
iii)



3

(into page)

Q2 a) USE SUPERPOSITION⁴
PRINCIPLE FOR
MAGNETIC FIELDS TO
ANSWER:

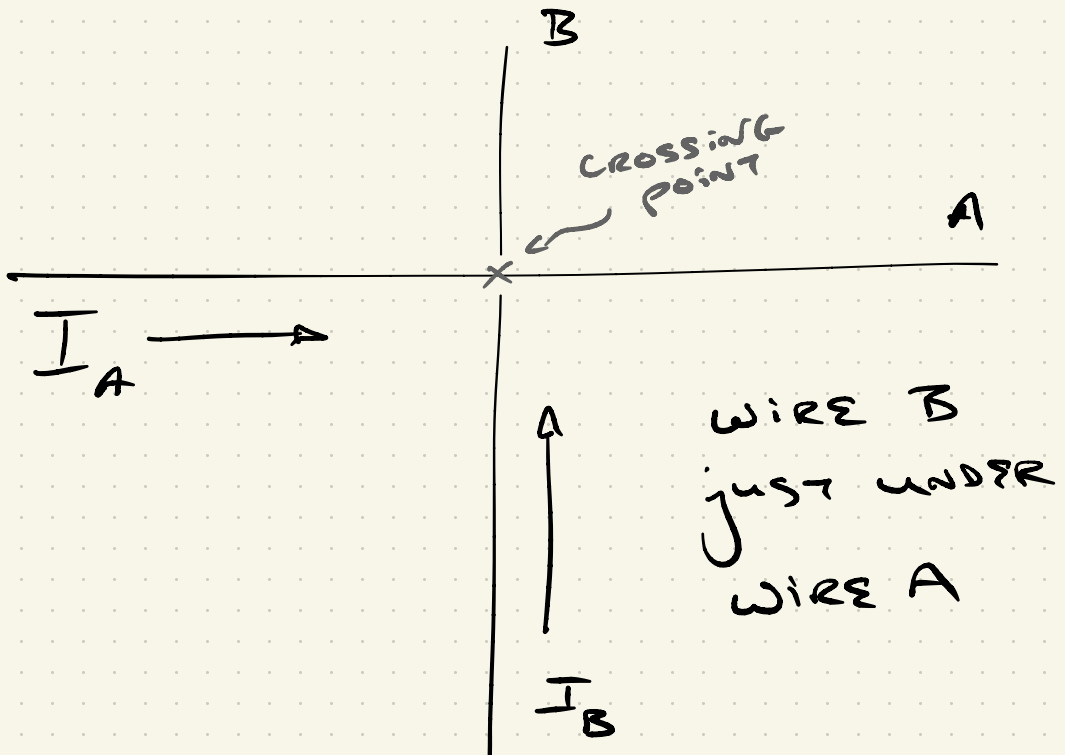


• **B** FIELD @ P STRONGER FOR
CASE **A** OR **B** ?

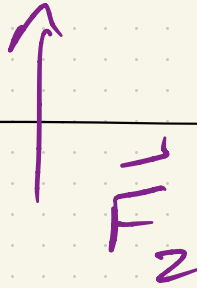
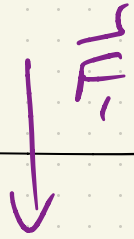
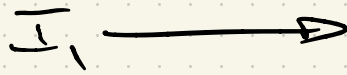
Q2b)

5

Why is the force between perpendicular wires zero at their crossing point (marked with the "x")?



Q2 c)



- if $F_2 > F_1$, THEN

THE STRENGTH OF

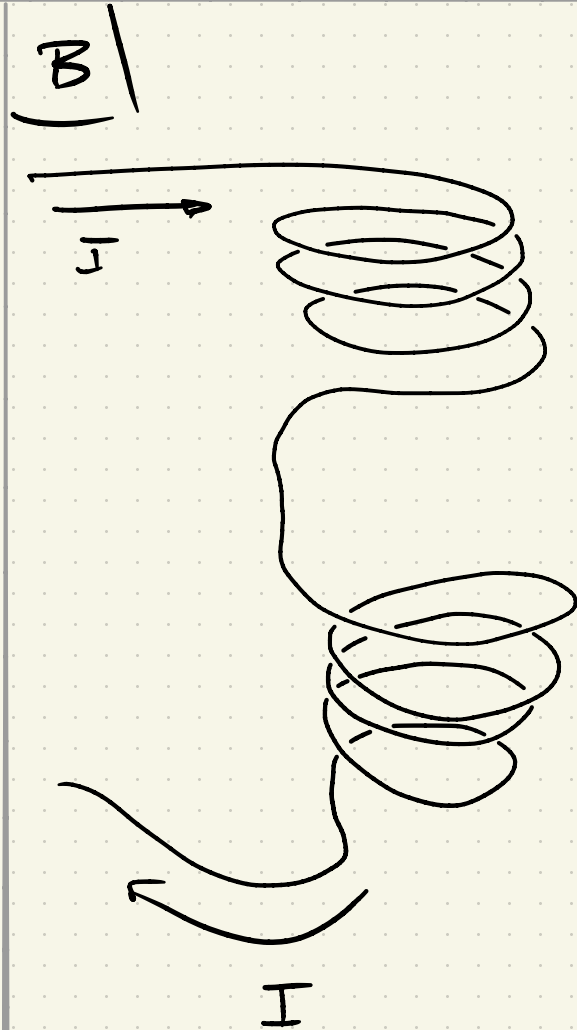
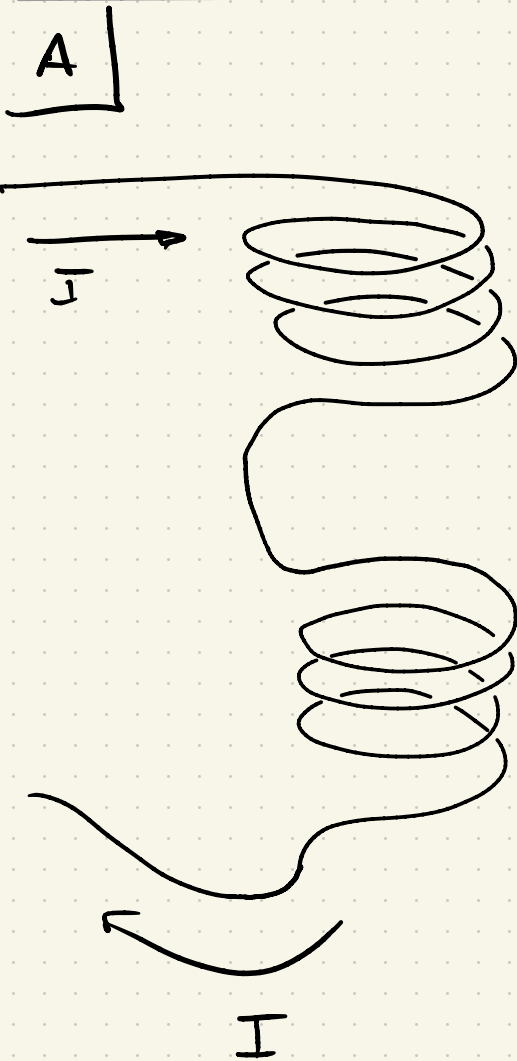
FORCE $|F_2|$ IS :

- $> |F_1|$?
- $< |F_1|$?
- $= |F_1|$?

7) Q3 a)

HINT: REPLACE COILS W/
BAR MAGNET EQUIVALENT.

In which arrangement (A or B) are the two coils attracted to one another?



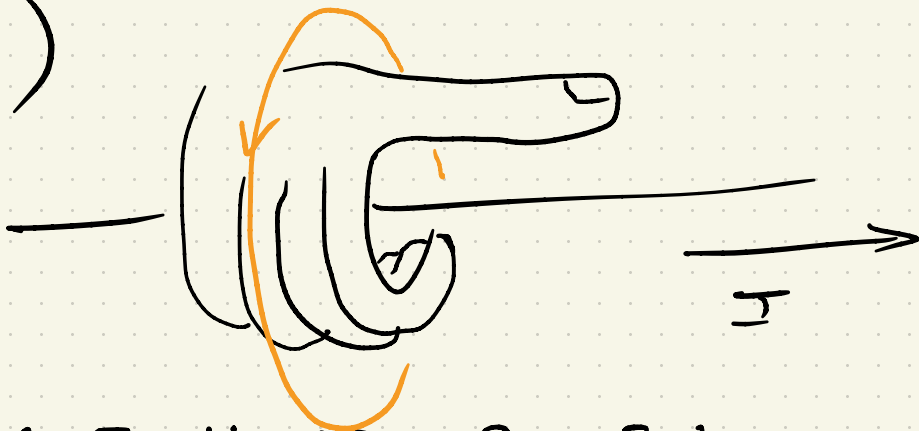
b) WHAT IF WE
NOW REVERSE
THE DIRECTION
OF THE CURRENT

ANSWERS

19

Q1 a)

i)



RIGHT HAND RULE:

OR: TO DRAW IN 2D:

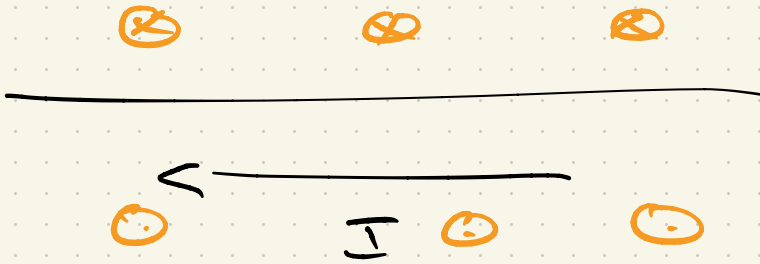


FINGERS POKE

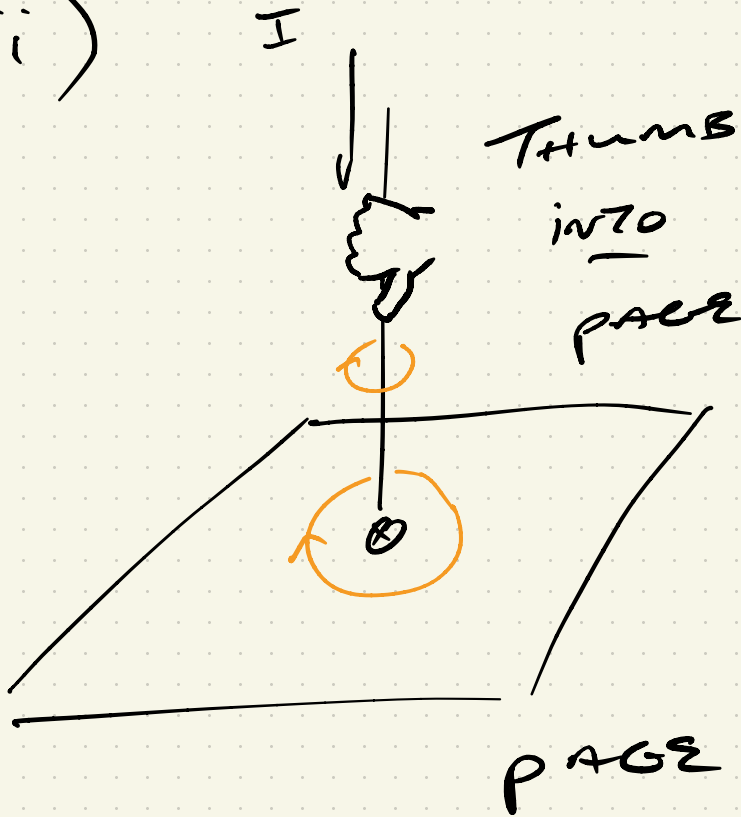
INTO PAGE ON THIS SIDE

Q1a) ii) opposite.

10

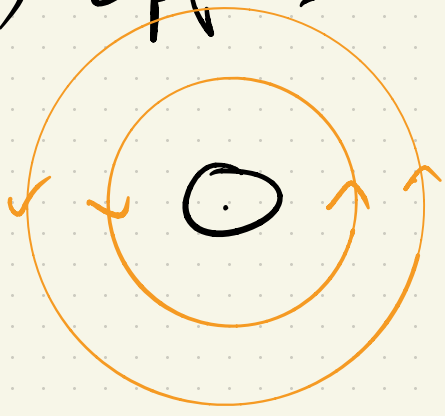


iii)



["

ii) opposites :



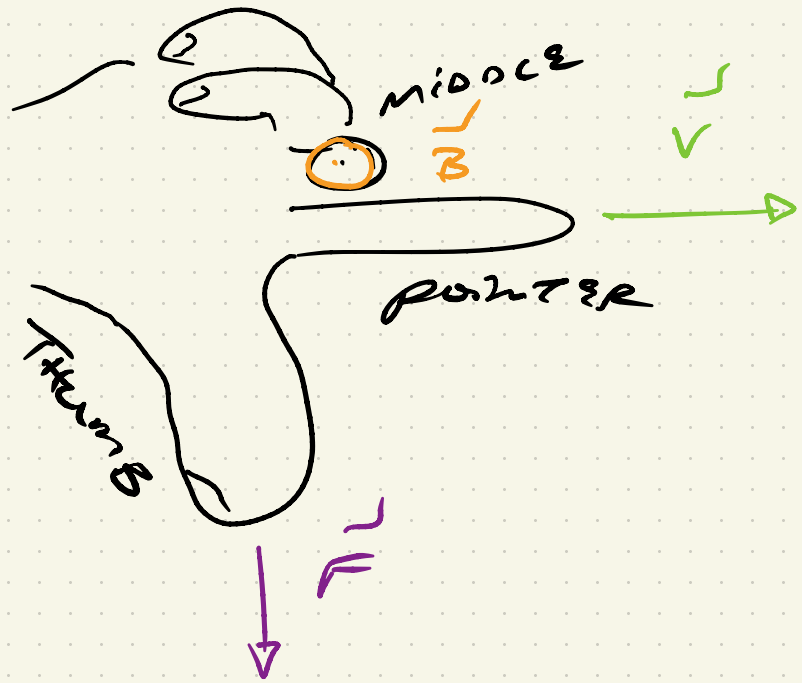
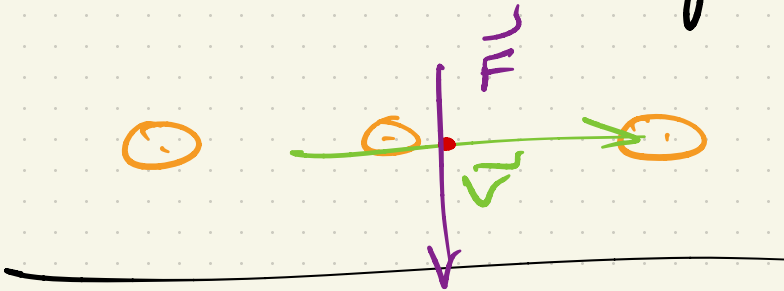
Q1 b) i)



FIRST DRAW \downarrow FIELD

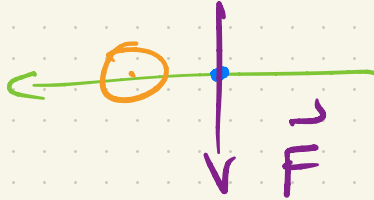
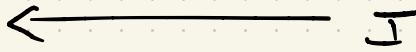
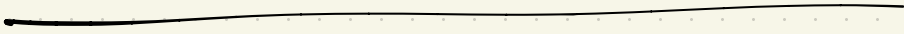
Due to wire
("RIGHT HAND RULE # 2")

THEN USE RHR #1 TO GET FORCE ON PARTICLE:



ii)

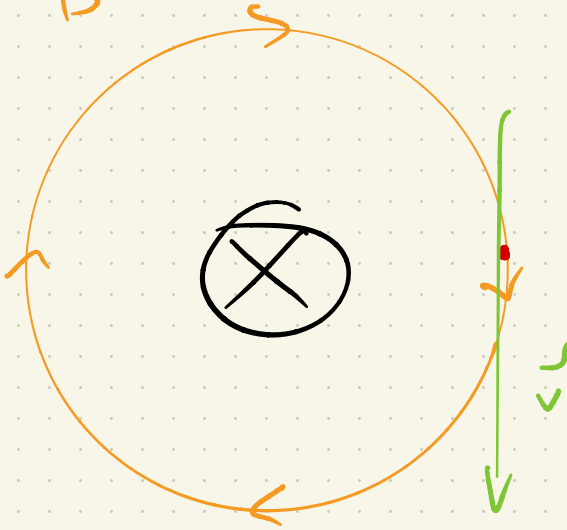
$\vec{B} \otimes$



$(q < 0)$

iii)

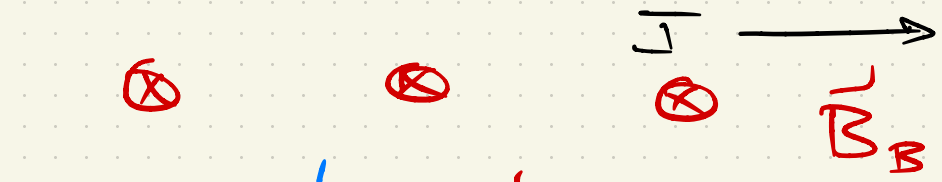
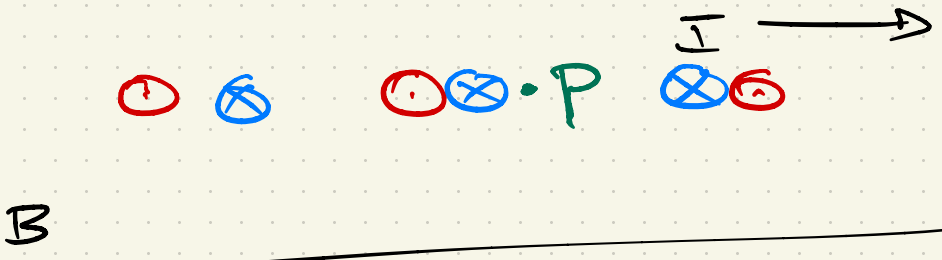
\vec{B}



$\vec{B} \parallel \vec{v} \rightarrow \vec{F}_L = 0$

Q2a)

14



C $P, \vec{B}_A + \vec{B}_B = 0,$

SINCE FIELDS POINT IN
OPPOSITE DIRECTION
AND FIELD STRENGTH IS THE
SAME (SAME CURRENT,
AND P IS HALFWAY BETWEEN.)

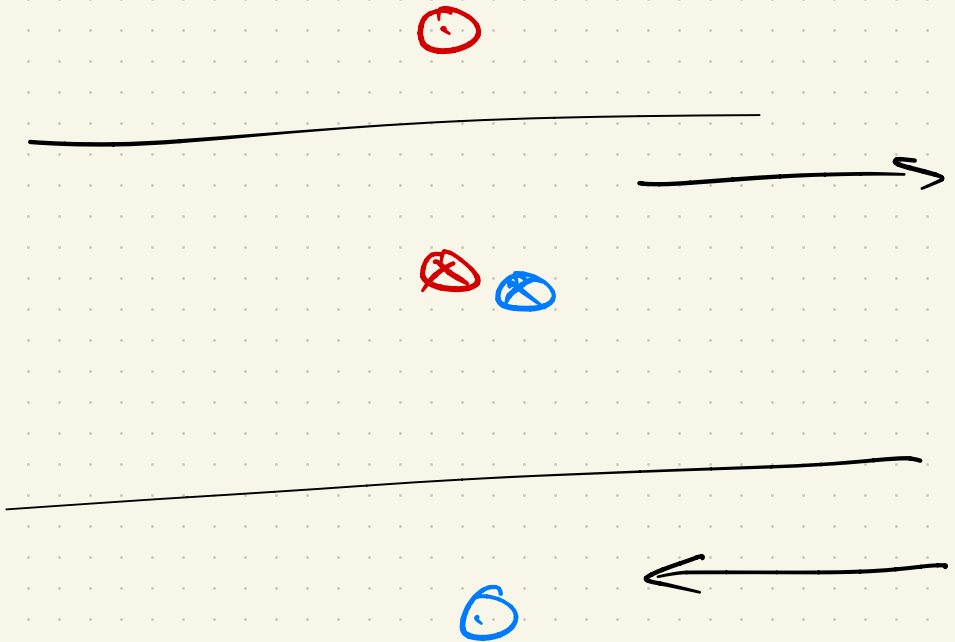
b) NOW FIELDS (15

\vec{B}_A & \vec{B}_B point

in same direction,

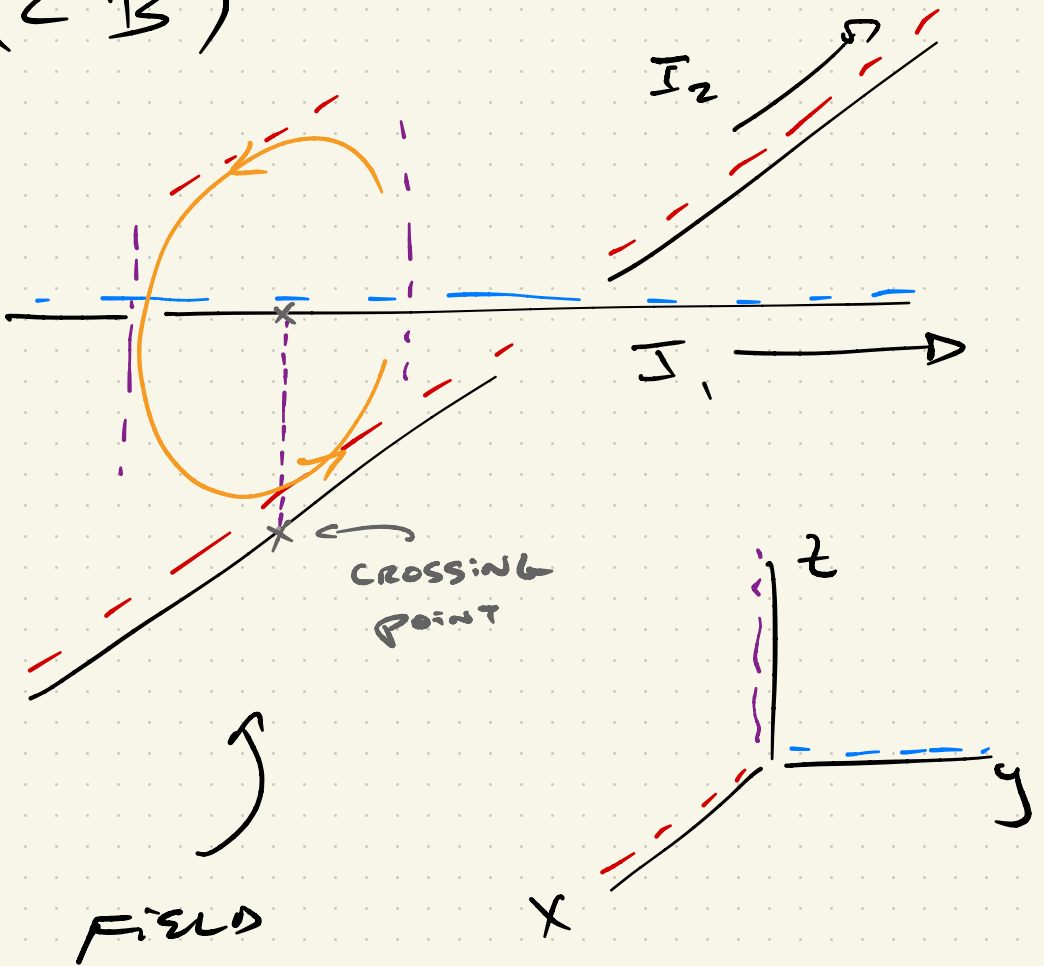
so they REINFORCE

EACH OTHER.



Q2 B)

116



\vec{B}

FIELD

DUE TO WIRE 1

IS PARALLEL TO

WIRE 2 @ CROSSING POINT,

SO $\vec{F} = 0$

Q2c)

17

• FORCE ON #1

By #2 is EQUAL

AND OPPOSITE

TO FORCE ON #2

By #1 By NEWTON'S

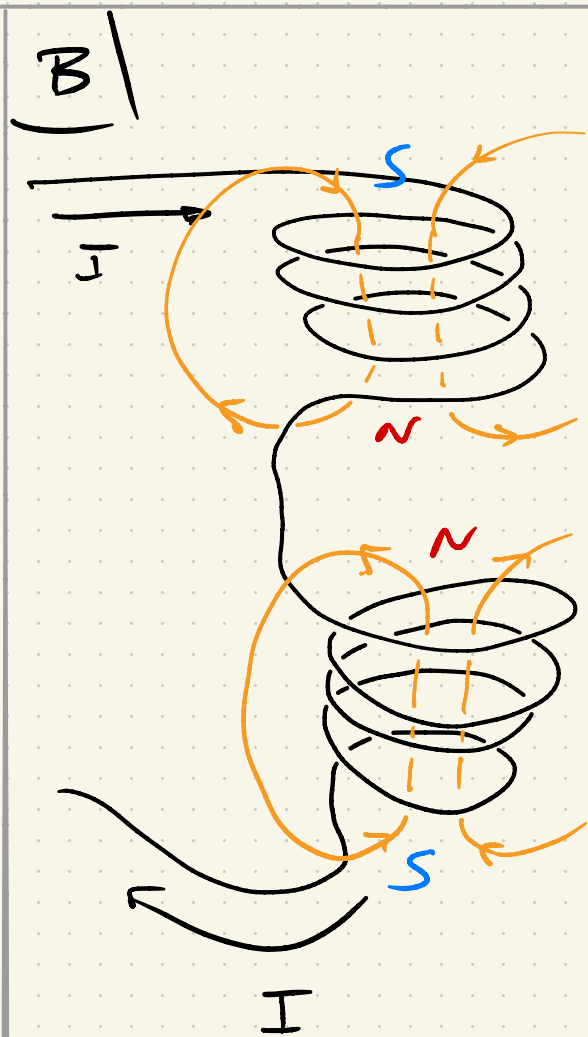
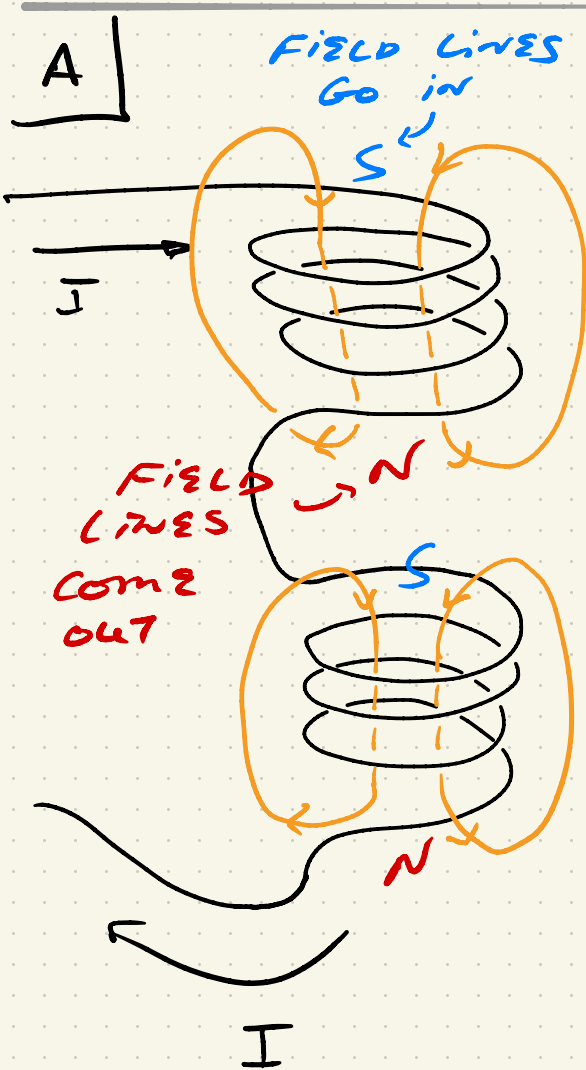
3RD LAW.

$$F_{1 \rightarrow 2} = \frac{\mu_0}{2\pi r} \cdot I_1 I_2 L$$

$$F_{2 \rightarrow 1} = \frac{\mu_0}{2\pi r} I_2 I_1 L$$

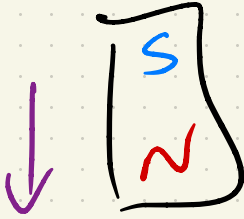
$$= F_{1 \rightarrow 2} \quad \checkmark$$

Q3a) USE R.H.R. #2 TO GET \vec{B} : [18

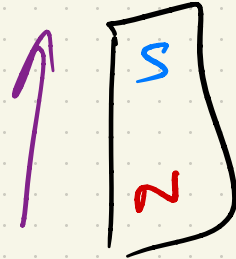


REPLACING W/ THEIR PERMANENT MAGNET EQUIVALENTS:

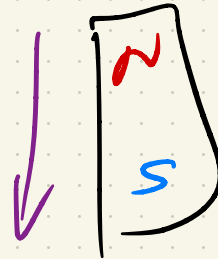
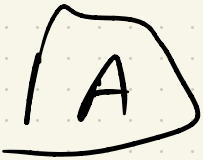
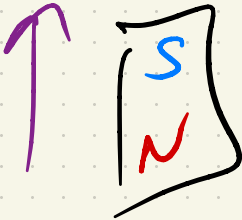
LA



ATTRACT



REPEL



Q3b) IF WE REVERSE

CURRENT :

S \rightarrow N

N \rightarrow S ,

BUT WE GET THE

SAME RESULT!

A : ATTRACT

B : REPEL