Magnetic Fields II

Name_____ ID_____ TA_____

Partners_____

Date_____ Section_____

Please do not look into laser beam directly, and be careful about dealing with the equipment. It is heavy and fragile.

1. Calibration of the Current Balance

**Please measure in SI units, which are kilograms, meters, newtons, amps, teslas, and seconds.*

	Mass (kg)	Weight (N) [mass × g(9.8m/s^2)]	Deflection (m)	

Try at least six different masses.

Calibration constant (slope of graph): k = _____(N/m)

2. Magnetic Field due to a Current in a Straight Wire

Hints to improve your experiment: (*Please do everything stated below.*)

☑ **Why don't you use the parallel (anti-parallel) current flow?**
In the last lab, you used the anti-parallel (parallel) current, which gave you a repulsive (attractive) force. Theoretically, when you use the parallel connection, you will obtain the

same amount of force (with the same current). However, if the apparatus has some idiosyncrasy, you might find a different result for this different alignment.

☑ **Why don't you use a multimeter?**
In the previous lab, you just read the current flow from the current source. However, can you trust it? Your science spirit may suspect the reading. The multimeter may give you a more accurate value. (*Please double check how to take the measurement with your instructor. It may be dangerous if the connection is wrong*.)

☑ **Why don't you use one of your ideas from last time?**
From previous lab, you wrote down some causes of errors and plausible solutions. One of them may give you a drastic improvement. Try it!

☑ **Why don't you use the uncertainty analysis?**
Any measurement has some uncertainty. If the deflection, x', has a few millimeter-uncertainty, how does it affect the final result? How about ℓ and r?

$\ell =$ _____(m) ⇦ The length of wire (metal rod)

$r =$ _____(m) ⇦ The distance between wires (rods).

Parallel Current Flows (Choose two different currents, but do not exceed 10 A)

	I (A)	x' (Deflection)	$F = k \cdot x'$(N)	$B = F/\ell I$	$B = 2\times10^{-7}\,\frac{I}{r}$
1					
2					

Anti-parallel Current Flows (Use the same two currents as above to be compared.)

	I (A)	x' (Deflection)	$F = k \cdot x'$(N)	$B = F/\ell I$	$B = 2\times10^{-7}\,\frac{I}{r}$
1					
2					

Please use this space for your own data and calculations.

For the lab report:

You will have to emphasize your conclusions and discussions. You do not have to write too many things for the procedure. The basic structure should be following:

1. What result did you obtain in the first lab?

2. What causes of errors did you identify from the first experiment?

3. How did you improve the lab to minimize the above causes of errors?
   At least use the current flows from the multimeter and do the uncertainty analysis provided in this sheet for your further discussion. How was your idea from last time? Are there any differences between parallel and anti-parallel current flows?

4. How much did you improve the experiment?
   Either you obtained more accurate data or not, please state possible, logical reasons for your results.

5. What do you conclude about the experiment?
   Please use your data to conjecture about the whole experiment.