Student's Name: Student's Name:

_____ _____

Lab day & time: _____ Date: _____

Direct Current Circuits (E4) – Data Sheets

Write all results on the data sheets in ink.

Activity 1: Measurements of Voltage, Current and Resistance Using a Digital Multimeter *(1 p.)*

1.2. The voltage measured between type "C" battery positive and negative terminals. Since the internal resistance of the digital meter is seven orders of magnitude larger than the internal resistance of the battery. the observed voltage is very close to the emf force for this battery.

emf $\mathcal{E}$ = _____ (V)

1.3. Resistance of the rheostat.

Minimum resistance of the rheostat = _____ (Ω)

Maximum resistance of the rheostat = _____ (Ω)

1.4. Using equipment that is available on the table, build a circuit that would have a given value of DC current $I = 22 \pm 1$ mA. Using equipment that is available on the table, build a circuit that would have a given value of DC current $I = 22 \pm 1$ mA. First, <u>calculate</u> the total resistance needed to create current $I = 22 \pm 1$ mA for the measured value of the emf force ($\mathcal{E}$) in a single loop circuit. Do not forget to connect the multimeter to measure that current. <u>Draw</u> your circuit in the space below.

Calculated total resistance in the single loop.

R = _____ (Ω)

Write the exact value of the measured current in you circuit.

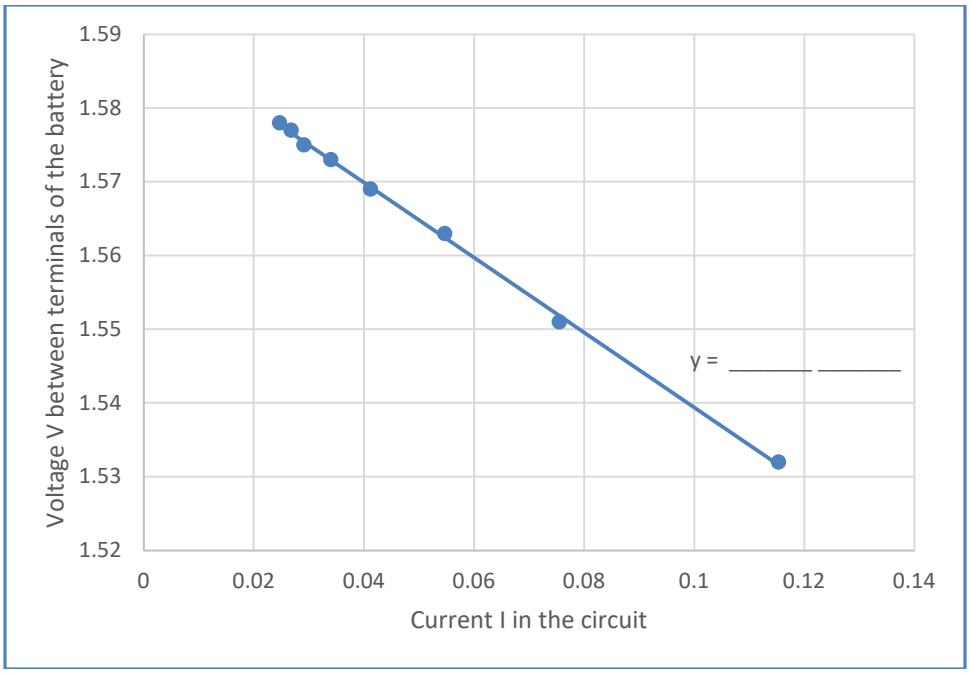
I = _____ (mA)

Activity 2: The Internal Resistance of Type "C" Battery *(2 p.)*

2.2. Record the eight values of the voltage across the battery and the current measured for random locations of the sliding contact on the rheostat.

Voltage *V* across the battery (V)	Current *I* in the loop (mA)

2.3. Create a graph of the terminal voltage V vs. current I for your 10 points. Use MS Excel to prepare the graph. Make a straight line fit to the experimental data of V vs. I. Attach the printout to your lab report. Below is an ***example*** of the V vs. I graph with the fit parameters numerical values hidden.



What is the slope of your graph? _____

What is the y-intercept of your graph? _____

Using the slope and y-intercept, record the emf of the battery and its internal resistance.

emf = _____ (V)

Internal resistance r = _____ (Ω)

What is the percent difference between the *emf* value obtained from the y-intercept of the V vs. I graph and the emf measured in *Activity 1*?

Percent difference = _____ (%)

Activity 3: A Multiloop Circuit *(2.5 p.)*

3.1-3.2. Assemble the circuit and **measure** the current: I_2.

Measured I_2 = _____ (mA)

Calculate the current I_2 using Kirchhoff's rules. (*Hint:* see the Theory section C in the file "E4 – Theory and Procedure") In your calculation, include the internal resistance of the battery r.

emf (from *Activity 2*) = _____(V)

Battery's internal resistance r (from *Activity 2*) = _____ (Ω)

Resistors: $R_1 = 20\ \Omega$, $R_2 = 10\ \Omega$, $R_3 = 100\ \Omega$

Calculated I_2 = _____ (mA)

Percent difference (absolute value) between the measured and calculated values of I_2

$$\left| {I_{2\ measured} - I_{2\ calculated}}/{I_{2\ calculated}} \right| * 100\% = \_\_\_\_\_ \ (\ \%\ )$$

3.4. Multiloop circuit that was used for measuring current I_3.

Measured I_3 current. I_3 = _____ (mA)

Calculate the current I_3 using Kirchhoff's rules. (*Hint:* see the Theory section C, file "E4 – Theory and Procedure") In your calculation, include the internal resistance of the battery r.

3.5. Calculated I_3 = _____ (mA)

Percent difference (absolute value) between the measured and calculated values of I_3

$$\left| {I_{3\ measured} - I_{3\ calculated}}/{I_{3\ calculated}} \right| * 100\% = \_\_\_\_\_ \ (\ \%\ )$$

3.6. Disassemble all components in your circuits and **turn off** both multimeters.

Complete the lab report and return it to the lab TA before the end of the scheduled lab time.